A

Project Report on

"ALCOHOL DETECTOR BASED CAR IGNITION SYSTEM"

Submitted in partial fulfillment of the requirement for the award of the

Degree of

Bachelor of Technology

In

ELECTRONICS AND COMMUNICATION ENGINEERING

From

Rajasthan Technical University

Kota (Rajasthan)

Under the Supervision of:

Mr. NEERAJ JAIN

(Supervisor)

Mr. RAGHAVENDRA PATIDAR
(Project incharge)

Submitted By:

YASH KHANDELWAL (08EMCEC56)

SHOBIT AGARWAL (09EMCEC203)

SANJAY KR. GUPTA (08EMCEC47)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

MODERN INSTITUTE OF TECHNOLOGY & RESEARCH CENTRE

ALWAR (RAJ.)

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

CERTIFICATE

Certified that this project report **"ALCOHOL DETECTOR BASED CAR IGNITION SYSTEM"** is the original work of **"Mr. SHOBIT AGRAWAL , Mr.YASH KHANDELWAL , Mr. SAJAY KUMAR GUPTA"** student(s) of B. Tech. Final year 8th sem (ECE) who carried out the project work under our supervision.

SIGNATURE	**SIGNATURE**
Mr. Raghavendra Patidar	**Mr. NEERAJ JAIN**
(PROJECT COORDINATOR)	**(SUPERVISOR)**
DEPARTMENT OF ECE	**DEPARTMENT OF ECE**
MITRC, ALWAR (RAJ.)	**MITRC, ALWAR (RAJ.)**

ACKNOWLEDGEMENT

It is always a pleasure to remind the fine people in my project work for their sincere guidance I received to uphold my practical as well as theoretical skills in engineering. Firstly I would like to thank **Mr. Raghavendra Patidar**(Asst. Prof., ECE Department MITRC) and other Lecturers for convincing me the fact "Whatever a man can imagine, that can be achieved", treating me as a son of his own and guiding me to taste the real flavor of engineering.

Secondly I would like to thank to all staff of MITRC for the positive attitude they showed for my work, always allowing me to question him and giving prompt replies for my uncertainties in all the fields including educational, social and managerial work and I always great him for his aspects of crew resource management who always said, "I may be wrong" or extending their friendship towards me and making a pleasure-training environment in the Engineering Workshops. A paper is not enough for me to express the support and guidance I received from them almost for all the work I did there.

Finally I apologize all other unnamed who helped me in various ways to have a good training. Knowledge is power and unity is strength.

PREFACE

In this system we propose that it will test driver's blood alcohol level by analyzing the breath exhaled into our system and the system will decide that the body alcohol level is in the range of legal level or not than it decide whether the vehicle will start or not. The system will be designed so that it will be able to interface with all current type of vehicle ignition systems.

There are some laws to punish drunken drivers but these laws cannot be fully utilized as police cannot stand on every road corner to check each and every vehicle driver whether he has drink or not. So there is a necessity to develop an efficient alcohol detector system which is situated in the vehicle and detects that the driver has drink or not. If the alcohol level is beyond the legal level then this system which is interfaced with the vehicle ignition system, will prevents the starting of the vehicle.

we propose to the Government of India that this alcohol detector system should install in each and every vehicle and makes compulsory it like seat belt for four wheelers and Helmets for two wheelers

CONTENTS

LIST OF FIGURES

CHAPTER-1

INTRODUCTION

The system we are designing will test an individual`s blood alcohol level by analyzing the breath exhaled into our system, in which the system will decide whether to let the individual start the car. We will be using an "Ensure" made by "Alcohol Countermeasures" to measure the blood alcohol level. The driver will then be signaled to breathe into our modified breath analyzer. If the driver passes the test he/she may start the car by pressing a start button or by drive the key that will control the starter for the vehicle.

The objective of this design is to help keep drunk drivers off the road. The system will be designed so that it will be able to interface with all current ignition systems. The user of the system will be given LED’s feedback at each stage (ie. whether they passed the blood alcohol test. These could be replaced by audio feedbacks the cost for future designs.

1.1 ISSUES:

In 2004, the National Highway Traffic Safety Administration reported that there were 16,694deaths and 248,000 people injured as a result of alcohol-related motor vehicle crashes. [Ref. 1, 2]Alcohol-related motor vehicle fatalities account for 39 percent of all motor-vehicle-relateddeaths. The NHTSA Administrator has stated that this fatality rate is a national concern duringher 2006 testimony to Congress, referring to the provisions in the Safe, Accountable, Flexible,and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) legislation to provideincreased funding to reduce impaired driving.

Fatalities and injuries due to motor vehicle crashes create particularly heavy losses to societywhen expressed as disability-adjusted life-years (DALYs), because the motor vehicle crashvictims tend to be young. (DALYs tabulate the number of years lost to premature death anddisabling injuries.) The public health community is increasingly aware of the losses world-widedue to vehicle accidents and forecasts that vehicle accidents will move from the ninth cause ofDALYS in 1990 to the third leading cause by 2020. [Ref. 3] The 16 to 20 and 20 to 24 age groupshave the highest fatality rate per 100,000 -- more than double the rate for the overall population, with a substantial proportion of these crashes being alcohol-related.

1.2 GOAL:

As part of the SAFETEA-LU legislation, the Secretary of Transportation was directed to conducta study on the potential for reducing the incidence of alcohol-related motor vehicle crashes andfatalities through advanced vehicle-based alcohol detection systems. Also included is anassessment of the practicability and effectiveness of such systems.[Ref.-5] NHTSA's Office ofHuman-Vehicle Performance Research has tasked the Volpe National Transportation SystemsCenter (Volpe Center) to assess the potential for vehicle-based technologies to prevent alcohol impairedcrashes. The purpose of this report is to identify vehicle-based technologies capableof detecting and preventing alcohol impaired driving. Research data will provide input to areport required to be submitted in 2007 to Congress.

1.3 APPROACH:

Impairment detection technologies have the potential to prevent serious crashes by stoppingimpaired drivers from starting or operating vehicles. Technology can detect driver BAC and lockout the driver or monitor driving performance for signs of impairment. If driver impairment isevident, the system can warn the driver and or impose any of a range of measures to mitigaterisk.. This report assesses the ability of technologies, existing and anticipated, to detect driverimpairment from alcohol and identifies international state-of-the-art vehicle-based technologyoptions to prevent alcohol-impaired automotive crashes. This analysis was carried out with thesupport of the Intelligent Vehicle Initiative (IVI) program, created in 1998 as part of theDepartment of Transportation ITS program.

The IVI program focuses on the collision warningsystem as an effective tool to reduce the number of accidents by providing effective and timelywarnings to drivers.The Volpe Center team interviewed stakeholders and interested parties and reviewed researchresults to assess the capability of vehicular technologies to reduce alcohol-impaired driving.The team acquired academic expertise both to review post-1995 literature and to identifyinternational sources of expertise for vehicle-based alcohol impairment detection.The research team collaborated with European experts to acquire first-hand information aboutthe results of the EU projects: System for the Effective Assessment of the Driver State andVehicle Control in Emergency Situations (SAVE) and System for Effective Assessment of Driver

Vigilance and Warning According to Traffic Risk Estimation (AWAKE), the plans andintent of the EU project Advanced Sensor Development for Attention, Stress, Vigilance andSleep/Wakefulness Monitoring (SENSATION), and the status of relevant research by Europeaninstitutes on vehicle-based alcohol impairment identification and countermeasures.

In addition,the European collaborator conducted personal interviews with six major European stakeholdersrepresenting technology developers such as original equipment manufacturers and suppliersand EU government agencies about vehicle-based alcohol impairment identificationand countermeasures.

1.4 OVERVIEW OF REPORT:

This report describes the most effective means of measuring alcohol impairment and the strategiesfor implementing technology-based countermeasures. The report estimates the potential forcrash reductions as a result of introducing TOPIC (Technology of Prevent Alcohol-Impaired Crashes) in relation to fatalities and injuries avoided;describes the strengths and weaknesses of near-term approaches, including breath alcoholignition interlock devices (BAIID) for DUI offenders; evaluates current and emerging crashavoidance technologies; identifies cross-cutting implementation issues likely to accompany theintroduction of these technologies; identifies research needs; and provides a concept ofoperations using promising technologies.

1.5 POTENTIAL FOR CRASH REDUCTIONWITH TECHNOLOGY TO PREVENTALCOHOL-IMPAIRED CRASHES:

This section describes the methodology for estimating the impact of widespread use of TOPIC and the number of alcohol related crashes TOPIC might prevent. These estimates provide abaseline to assess the potential impact of a universal adoption of TOPIC.

Although the incidence of alcohol-related fatalities has declined over time, the rate of decline hasslowed and developments in technology, such as TOPIC, may offer a way to prompt moredramatic decreases. The proportion of high-BAC involvement in fatal crashes has dropped fromthree-fifths to two-fifths of the crashes during the last 25 years, but the rate has leveled off toaround two-fifths of the crashes during the past 10 years.[Ref.- 6] NHTSA expresses the incidence asalcohol-related fatalities per 100 million vehicle miles traveled (VMT) to reflect exposure.[Ref.-7]Alcohol-related fatality rate per 100 million VMT, 2002-2004[Ref.- 8] shows the incidenceof fatalities and alcohol-related fatalities in recent years. A longer view shows the rate offatalities per 100 million VMT with driver BAC=.08+ dropped from 1.46 in 1984 to 0.64 in 1994and 0.43 in 2004.[Ref.- 9]

1.6 TECHNOLOGIES IN USE:

The interlocks in current use are secondary interlocks, i.e., secondary to apprehension for a DUI offense. Most States impose interlocks only on repeat offenders, although there are a few jurisdictions in which their use is an option for first offenders. The BAIID is an aftermarket product hardwired into the ignition circuit of a vehicle that prevents the vehicle from starting until a breath sample has been given, analyzed for ethanol content, and found to be below programmed limits. For proprietary reasons, the interlock manufacturers are reluctant to release their sales figures and there are no official estimates of the number of interlocks in use. However, in the course of our interviews with the chief executives of all of the U.S. manufacturers, we heard estimates of 85,000 to 100,000 units in use in 2006. These estimates were provided on a “not for attribution” basis.

The BAIID hardware consists of a handheld sensor unit together with an under-dash unit that contains the interface to the vehicle’s ignition and power circuits. Nearly all units now in service contain fuel-cell ethanol sensors, as well as sensors for breath temperature, pressure and/or air flow. A logic circuitperforms the following functions:

1. Each time a driver attempts to start, the controller first turns on the heater in the fuelcell and delays further action until the proper operating temperature has been reached.In very cold conditions, this may take as much as 3 minutes, but 30 seconds is typicalin mild weather.

2. The unit then signals the driver to blow a sample. Accurate estimation of BACrequires the air sample to be from deep in the lungs, so the driver must take a deepbreath and blow long and hard. Based on signals from the pressure and flow-ratesensors, the controller limits its analysis of the ethanol concentrations to the lastportion of the sample. Blowing a sample with acceptable characteristics in terms ofpressure, volume and/or flow rate requires training. Some units include a microphoneand demand that the driver hum while blowing. Without training and practice inblowing an acceptable sample, it is difficult for a sober individual to substitute for adrinking driver. Failures to blow an acceptable sample are logged.

3. If an acceptable sample is blown and found to contain less than the programmed limitfor ethanol – usually .02 or .025 BAC among DUI drivers in the U.S. – the vehiclecan then be started normally.

4. If the sample exceeds the limit, the ignition is locked out for some period of time andthe date, time, and ethanol concentration are logged. After some period of time –typically 5 to 30 minutes – the controller signals that another sample may be given.

1.7 CERTIFICATION OF INTERLOCK DEVICES:

There is general agreement that despite the need to embed the interlock in a more comprehensive program, the physical interlock device does accomplish its originally intended purpose, with fuel-cell technology providing the best alcohol specificity and measurement stability. Guidelines published by the United States (U.S.) National Highway Traffic Safety Administration (NHTSA, 1992), known as the Model Specifications, were well suited to the understanding and technology then available. Those guidelines aptly described the minimally needed performance characteristics for non-specific semiconductor-type interlock devices used in mid-latitude climate zones. Today, the more alcohol-specific fuel-cell devices have begun to dominate the world markets. [Ref.-10] The NHTSA guidelines were also written to give states wide flexibility in designing interlock programs. Experience gained during the past ten years has now made it clear that the federal authority needs to play a more active role. With ten years of interlock experience in dozens of different jurisdictions, older guidelines are now overdue for public comment and revisions; the NHTSA guidelines specifically advocated periodic revision.

Subsequent to the issuance of the 1992 U.S. guidelines, some confusion in device certification arose in the U.S. that other nations can avoid. In those guidelines, the NHTSA chose to not manage device certification for interlocks as it had for other devices (i.e., evidential devices, alcohol screening device and calibrating units)[Ref.-11]. One consequence of this has been some manufacturers shopping around for commercial laboratories, sometimes several laboratories, in order to gain certification documents to “prove” their equipment complies with the guidelines. In addition, there is evidence that some laboratories have certified a device without performing all of the required tests. To avoid potential problems related to non-standardization, there should be a single responsible authority, such as a federal government laboratory or a laboratory authorized by the federal government, to assess the adequacy of all equipment that will be placed in service in that country[Ref.-12]

In the early 1990s, the running (or rolling) retest requirement (additional BAC tests while the vehicle is operating) became an important addition to device certification requirements in both the U.S. and Alberta, Canada. These additional tests are widely believed capable of preventing several types of interlock circumvention attempts. Currently, the NHTSA guidelines advocate one running retest and the Alberta, Canada standard (Electronics Test Centre, 1992) requires multiple running retests. Neither the effectiveness of single nor multiple retests, nor the best frequency for retesting, have been formally evaluated[Ref.-13]. Certification requirements would benefit from periodic research to evaluate the necessity of the features advocated. Currently, the Alberta, Canada standard, written in 1992, is the most widely used guide to alcohol ignition interlock device certification

CHAPTER-2

FEATURES

VEHICLE-BASED IMPAIRMENT DETECTION

Countermeasures that detect impaired driving through objective behavioral measures coulddecrease crash risk beyond what is possible through direct alcohol detection. Progress has been made in defining physiological measures that have potential for in-vehicle use. Ocular, gaze, and eye-movement measures have demonstrated sensitivity to alcohol impairment, but their implementation in vehicles remains a challenging problem, especially in sunlight. Other physiological measures require head-worn sensors that render them unattractive for general use.

Some progress has been achieved in the detection of alcohol impairment through driving performance measures, as exemplified in the European Union's Project System for the Effective Assessment of the Driver State and Vehicle Control in Emergency Situations (SAVE), which employed a multiplicity of sensors feeding a neural network. In the SAVE experiments, the variables included:

- Smell from mouth of driver;
- Eye blink;
- Eyelid closure;
- Steering wheel grip;
- Mean lane position (relative to right lane marking);
- SD of lane position;
- SD of steering wheel position;
- Mean speed;
- SD of speed; and
- Time to lane crossing.

However, using state of the art technology in the form of individualized neural-network detectors, SAVE correctly detected alcohol (BAC = .05 g/dL) in only 78 percent of trials and generated false alarms in 8 percent of the trials. Additional progress is required before this approach can be considered for practical use. The primary benefit of behavioral definitions is that they will detect impairment caused by BAC levels less than the per se limit, such as impairment resulting from low levels of alcohol combined with fatigue or other factors. However, some amount of driving is required before detection occurs, so unlike ignition interlocks, they cannot completely prevent impaired driving.

Further, it is important to individualize baselines when assessing the effects of alcohol, drugs,and medicines on driving behavior. The “natural” or unimpaired behavior of the driver should be known before additional effects can be estimated. The individualized “signature” of alcoholinfluence driving may include indicators that have no relevance to crash risk. For this reason, a general baseline comprised of behaviors that result in increased crash risk must be combined with the alcohol signature to identify alcohol impaired driving.

CHAPTER-3

DESIGNING OF THE SYSTEM

The objective of this design is to help keep drunk drivers off the road. Block diagram of this system as follows:

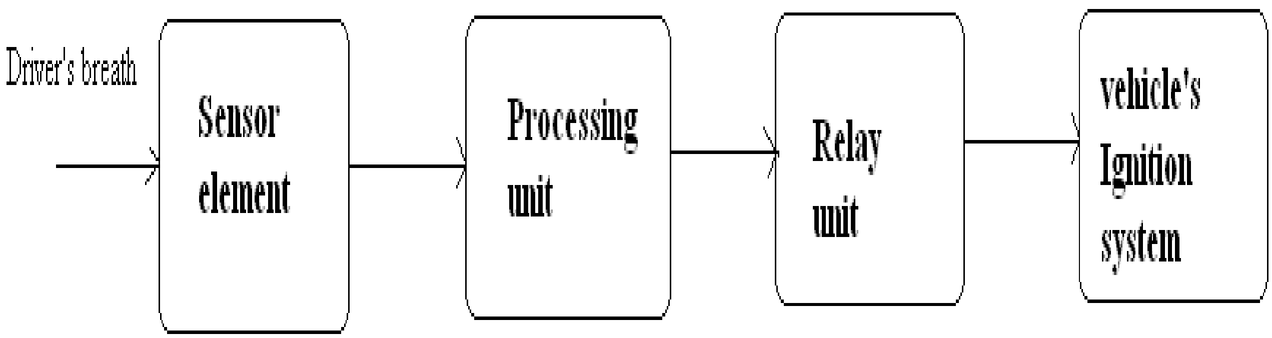


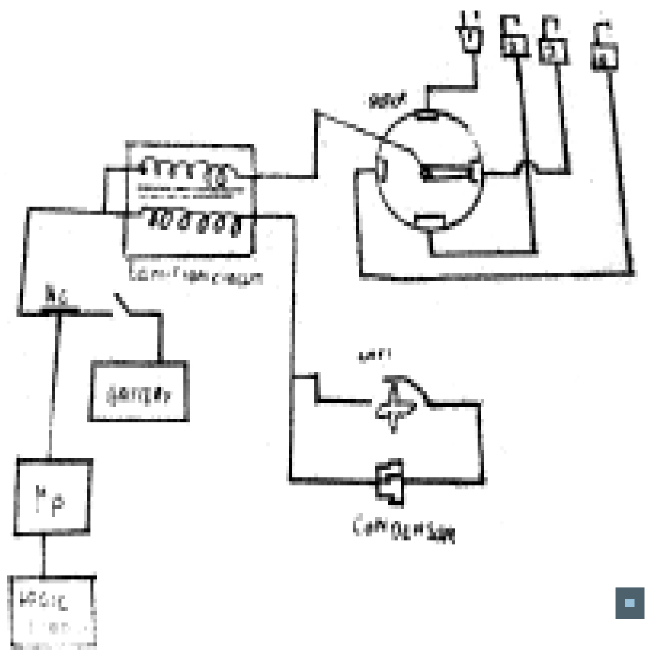
Fig. 3.1- Block Diagram of BAIID System

3.1 The Sensor: The sensor consists of a semiconductor material mounted on a ceramic tube; it is protected by a double layer of 100-mesh-per-inch stainless steel screening. When the alcohol tester is turned on, the sensor is heated to normal operating temperature. During this process, oxygen is absorbed into the semiconductor surface. This causes a depletion region to form betw1een the surface and the body of the sensor. In turn, this increases the resistance of the sensor. When an intoxicated person blows on the sensor, the alcohol is absorbed into the semiconductor surface and reacts with the oxygen that is already there. This decreases the sensor`s overall resistance in proportion to the alcohol concentration.

3.2 Processing unit: When an intoxicated person blows into the device and the sensor detects alcohol, its resistance decreases, this changes the input voltage to the detector circuit. This voltage change can be calibrated in the form of blood alcohol level and processed and if the blood alcohol concentration (BAC) is larger than the legal limit then a signal is given to the relay.

3.3 Relay unit: A relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a low-power signal or where several circuits must be controlled by one signal. Relay is connected with the ignition system of vehicle.

3.4 Ignition system: The battery supplies large power to the spark plug so direct interfacing of the logic circuit will burn the IC's. so relay switches are used. The battery circuit consists of a NC relay switch. The NC switch is controlled by a solenoid which is energized by the signals from the logic circuit. The power for energizing the coils is obtained by amplifying the IC signals using a transistor. The logic circuit we use automatically opens the ignition circuit. Now when the logic circuit gives output as to an end without any result so the NC is left undisturbed. When no signal is obtained from the logic circuit that's logic zero, the processor's program runs fully and at the end of the program the solenoid of the NC is energized which pulls the NC switch off the circuit so the circuit is opened. Due to this the engine will not crank.



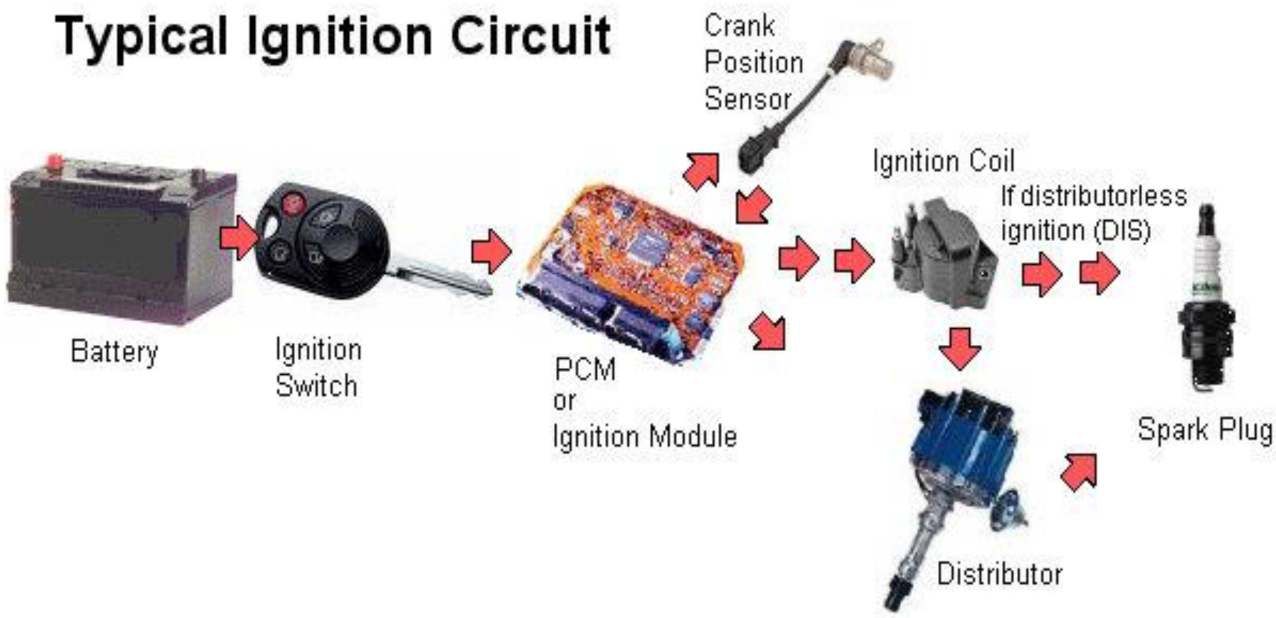


Fig 3.2: Typical Ignition System

CHAPTER-4

IMPLEMENTATION

4.1 The Circuit Diagram:

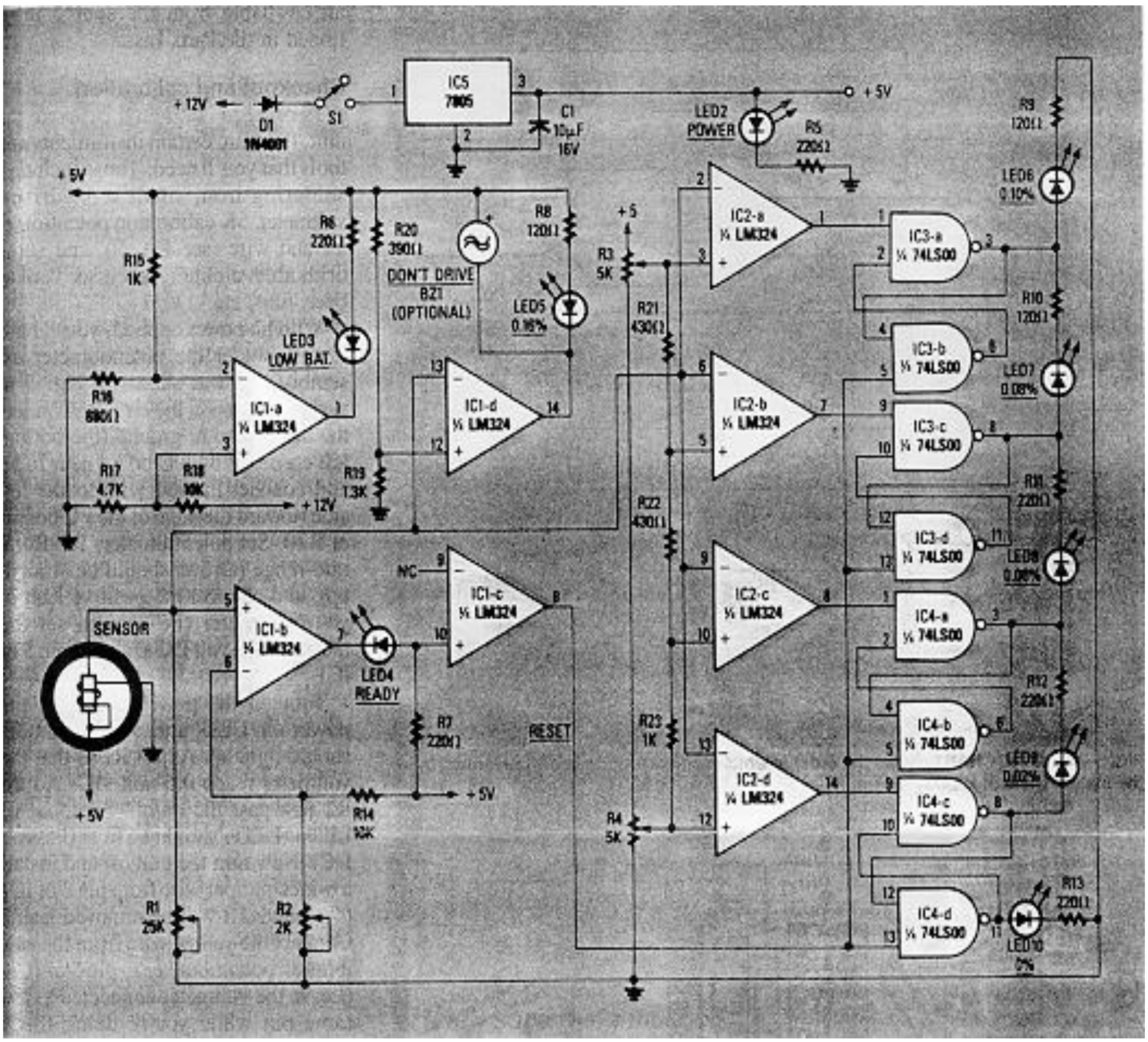


Fig. 4.1: The Circuit Diagram

4.2 Working: When the alcohol tester is turned on, the heater coil in the sensor is energized with 5 volts from a 7805 voltage regulator (IC5). The circuit cycles through a self-testing and warm-up period. The circuit resets itself to 0-alcohol reading and sets off the ready light.

When an intoxicated person blows into the device and the sensor detects alcohol, its resistance decreases; this changes the input voltage to the detector circuit. The detector circuit is made up of a quad op-amp. The detector circuit is calibrated by 2 resistors (R3 and R4), and the inputs to each section are controlled by a voltage-dividers (R21-R23). As each section is activated, the outputs go low and the sample-and-hold circuitry will latch onto the highest input value and trigger the appropriate LED. Different colored LEDs represent different alcohol levels.

If the detected alcohol level is above the legal limit (0.1%), another op-amp will trigger a buzzer and the LED corresponding to an "over the limit" level of alcohol. This indicates that the person is too drunk to drive.

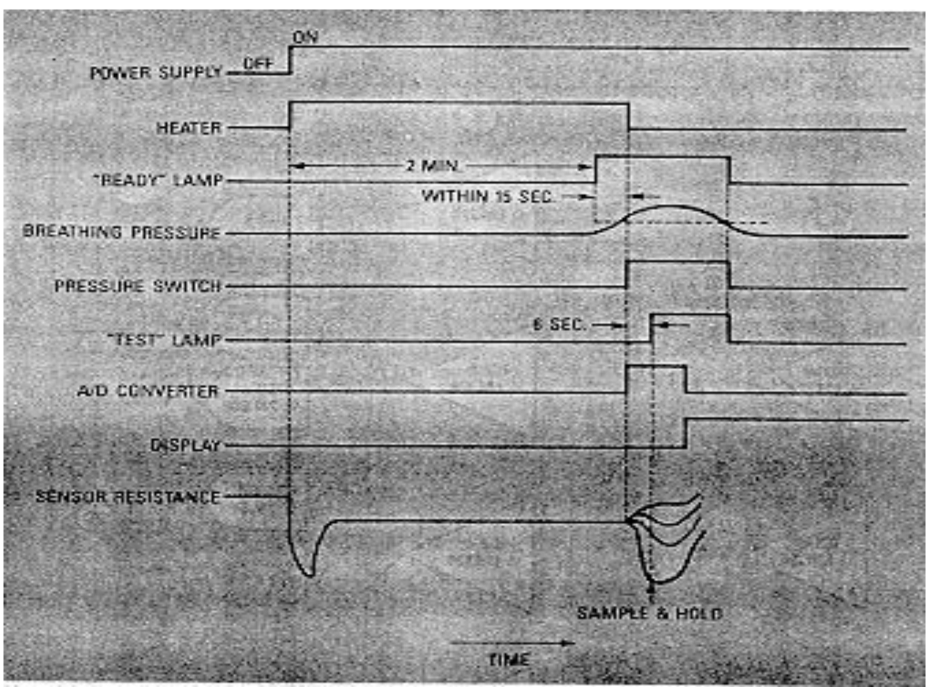


Fig. 4.2- Time Chart for the CKT

The alcohol tester must be calibrated using the potentiometer; this must be done before initial use and should be repeated after 10 uses. After a test, the sensor takes a few seconds to ready itself for another test. During this time, the circuit resets itself and the ready light will come on again. This design includes a low battery light indicator. When this light comes on, the batteries must be changed to insure accurate test results. To get accurate test results, do not drink or smoke 15 minutes prior to taking the test.

4.3 PCB DESIGN AND LAYOUT :

PRINTED CIRCUIT BOARD:

The use of miniaturization and sub miniaturization in electronic equipment design has been responsible for the introduction of a new technique in interscomponent.

The printed circuit boards (PCBs) consist of an insulating substrate material with metallic circuitry photo chemically formed upon that substrate. Thus PCB provides sufficient mechanical support and necessary electrical connections for an electronic circuit.

Fig. 4.3- Printed Circuit Board

Advantages of printed circuit boards:

- Circuits characteristics can be maintained without introducing variations inter circuit capacitance.

- Wave soldering or vapor phase reflow soldering can mechanize component wiring and assembly.
- Mass production can be achieved at lower cost.
- The size of component assembly can be reduced with corresponding decrease in weight.
- Inspection time is reduced as probability of error is eliminated.

TYPES OF PCB:

There are four major types of PCB's: -

1) Single sided PCB: - In this, copper tracks are on one side of the board, and are the simplest form of PCB. These are simplest to manufacture thus have low production cost.
2) Double sided PCB:- In this, copper tracks are provided on both sides of the substrate. To achieve the connections between the boards, hole plating is done, which increase the manufacturing complexity.
3) Multilayered PCB: - In this, two or more pieces of dielectric substrate material with circuitry formed upon them are stacked up and bonded together. Electrically connections are established from one side to the other and to the layer circuitry by drilled holes, which are subsequently plated through copper.
4) Flexible PCB: - Flexible circuit is basically a highly flexible variant of the conventional rigid printed circuit board theme.

PCB Manufacturing Process:

There are a number of different processes, which are used to manufacture a PCB, which is ready for component assembly, from a copper clad base material. These processes are as follows

- Preprocessing: - This consists of initial preparation of a copper clad laminate ready for subsequent processing. Next is to drill tooling holes. Passing a board through rollers performs cleaning operation.
- Photolithography: - This process for PCBs involves the exposure of a photo resist material to light through a mask. This is used for defining copper track and land patterns.
- Etching: - The etching process is performed by exposing the surface of the board to an etchant solution which dissolves away the exposed copper areas .The different solutions used are: FeCl, CuCl, etc.

- Drilling: - Drilling is used to create the component lead holes and through holes in a PCB .The drilling can be done before or after the track areas have been defined.
- Solder Masking: - It is the process of applying organic coatings selectively to those areas where no solder wettings is needed .The solder mask is applied by screen-printing.
- Metal Plating: - The plating is done to ensure protection of the copper tracks and establish connection between different layers of multiplayer boards. PCBs are stacked before being taken for final assembly of components .The PCB should retain its solder ability.
- Bare-Board Testing: - Each board needs to ensure that the required connections exist, that there are no short circuits and holes are properly placed .The testing usually consists of visual inspection and continuity testing

PCB LAYOUT:

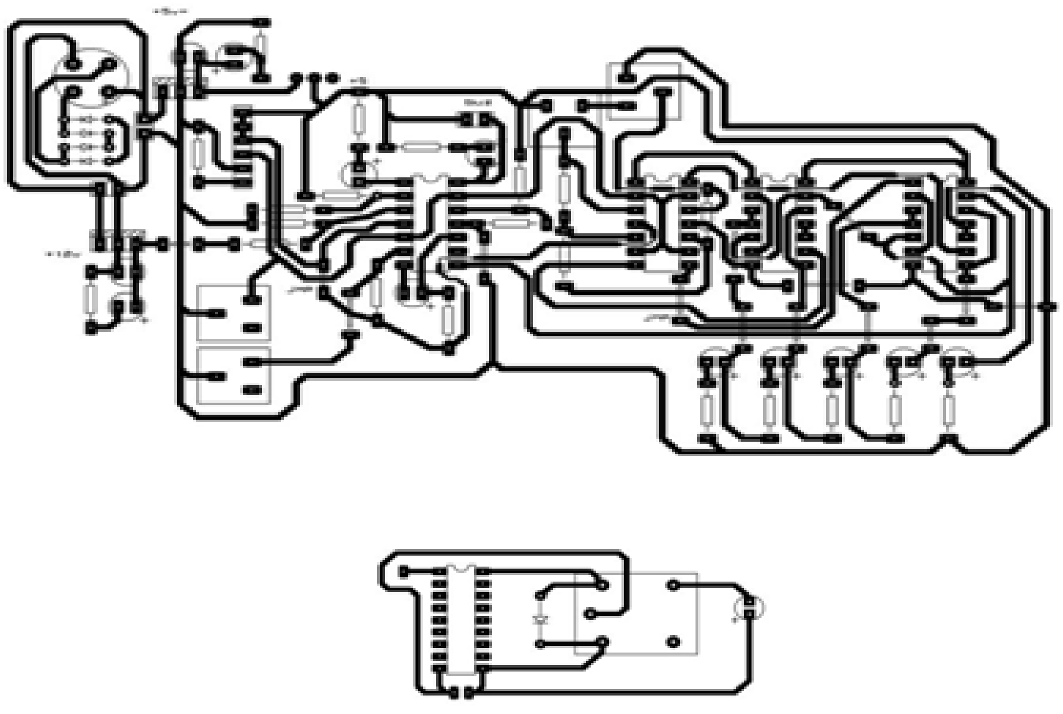


Fig 4.4 – The PCB Layout

4.4 Component used:

Resistors [All Resistors are 1/4-watt, 5%]

R1 .... 25k ohms trimmer potentiometer

R2 .... 2k ohms trimmer potentiometer

R3,R4 .... 5k ohms trimmer potentiometer

R5-R7,R11-R13 .. 220 ohms

R8-R10 .... 120 ohms

R14,R18 .... 10K ohms

R15,R23 .... 1K ohms

R16 .... 880 ohms

R17 .... 4.7K ohms

R19 .... 1.3K ohms

R20 .... 390 ohms

R21,R22 .... 430 ohms

Capacitors:

C1 .... 10uF, 16 volt, electrolytic

Semiconductors:

IC1,IC2 .... LM324 quad op-amp

IC3,IC4 .... 74LS00 quad 2-input NAND gate

IC5 .... 7805 5 volt regulator

D1 .... 1N4001 diode

LED2, LED4, LED10 Green (LEDs)

LED3, LED5, LED6 Red (LEDs)

LED7........... Amber (LEDs)

LED8, LED9 ...... Yellow (LEDs)

Sensor:

SEN1 .... MQ-3 semiconductor alcohol sensor

Miscellaneous :

BZ1 .... Piezo buzzer

S1 .... SPST (on/off) switch

Copper Clad PCB

Soldering Iron

Soldering wire

CHAPTER-5

RESULTS

With the completion of our system we realized that this idea could be very effective against drunk drivers. We found a couple of commercial models which range from $500-$700 dollars. The final cost of our system was $25. Note that our system included a keyless ignition control system and a voice chip to signal the driver that they could start the car.

The most difficult part of our design was bring together all the different systems and integrating them into a robust and reliable product. When testing the design we noticed that it would be aggravating for the driver to wait 35 seconds for the alcohol sensor to warm up. In future designs of this system the designers should look at ways of speeding up this process.

The sensor, which claims to be a blood alcohol tester, actually measures the amount of alcohol that is in your breath. We noticed that if you drank on sip of beer and quickly breathed on the sensor that you would be registered as legally drunk when in fact you weren`t. Overall, the system work better than we expected and hopefully the state will look at using such system to keep drunk drivers off the road.

CHAPTER-6

ADVANTAGES

1. It helps in reducing road accident at a large extent.

2. It eradicates the inconvenience caused when a driver is pulled down by the police

the check whether he has consumed alcohol.

3. The time taken for the test is maximum ten seconds

4. The cost for installation is very cheap.

5. Huge alteration in design of the car is not required.

CHAPTER-7

PERFORMANCE AND LIMITATIONS

The BAIID is a mature technology with performance characteristics that are generally adequate to sharply reduce DUI recidivism among the offenders required to use it. There are inherent limitations in breath-alcohol testing as a means of estimating true blood alcohol concentration, and the relation of BAC to impairment varies somewhat among individuals. However, these are of little consequence in the offender-interlock application, because its intent is to prevent driving after any drinking. Discrimination between BAC levels of .07 versus .08 is far more challenging.Breath alcohol concentration (BrAC) analyzers were developed in the 1950s and have become the main proof of intoxication in prosecutions. Earlier devices for the evidential market involved multistage wet chemistry and photometry. Currently, infrared spectrometers are considered the most accurate technology and dominate the evidential market. Some include a fuel cell to provide two independent tests from each driver.

The NHTSA specification for the error (standard deviation) in measurements is .0042 g/dL BrAC for both evidential instruments and interlocks.The manufacturers of the evidential instruments publish an error specification on the order of .003 g/dL BrAC. While these instruments can measure breathe alcohol quite accurately, that is not the same as measuring BAC. The ratio of BrAC to BAC, known as the "partition ratio," varies between 1: 1,900 and 1:2,400. In the United States, it is defined by statute to be 2,100, but other nations have selected other values. Within measurements on the same individual, the partition ratio has been shown to vary with body temperature, vigorous exercise, presence of alcohol in the mouth, and whether BAC is rising or falling.

To obtain readings that will stand up in court, police officers wait at least 15 minutes to ensure that mouth alcohol has dissipated and keep the driver seated in a controlled-temperature environment. Breath temperature is tested to ensure that it is within the narrow limits that allow a valid reading. Because partition ratios vary, to avoid "reasonable doubt" in court, BrAC analyzers are biased to estimate BAC lower than its true value on average, as shown in Figure .

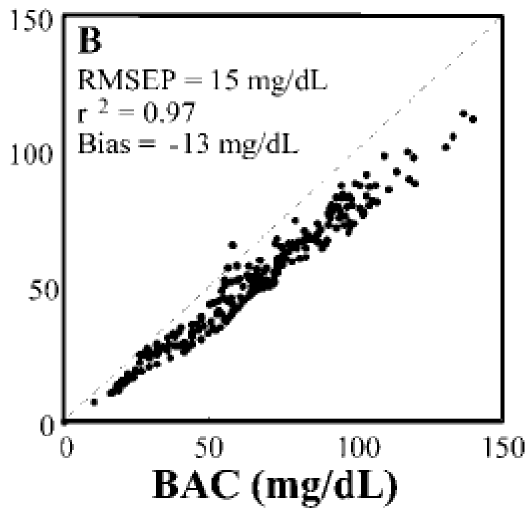


Fig.7.1- Comparison of estimates of BAC from BrAC analysis with true BAC9

The current specification for accuracy in BAIIDs devices is that they must lock out at least 90 percent of the time (18 out of 20 trials) when the alcohol concentration in the test sample exceeds the set point (normally .025 BrAC) by .01 BrAC. At extreme temperatures or under other conditions of stress, the allowable deviation from set point increases to .02 BrAC. Most interlock manufacturers use **fuel-cell sensors** today. This technology is fairly rugged and ethanol specific, but the fuel cell must be warmed up to breath temperature to meet the accuracy specification. This requires a heater assembly and significant energy use for heating; this is not a problem for a device that is hardwired to a vehicle, but is a major barrier to the use of fuel cells in wireless devices like key fobs.

For applications requiring small size and low battery drain, **solid-state sensors** are used to measure breath alcohol. When freshly calibrated, they can be almost as accurate as fuel cells, but they show considerable drift over time. Furthermore, they respond to several volatile organic compounds other than ethanol. Since their use for enforcement purposes has not been sanctioned, there is little public-domain data regarding their accuracy. Contamination is also a problem. Recent research suggests substantially improved accuracy and specificity may be obtained by replacing the current tin-oxide sensor with one constructed from perovskite crystals doped with strontium, but currently no complete monitors with this technology are available for testing. Recently developed gallium arsenide detectors are now being tested in Sweden.

The low interlock set point prohibits any driving after drinking. Because the standard prediction error in current interlocks amounts to at least .015 BAC from true BAC, in most U.S. jurisdictions, offender interlocks are programmed to trigger at .02 or .025 BAC -- far below the per se limit of .08 BAC, but comfortably larger than the error margin to prevent false positives. It might be possible for some individuals to consume one drink and still be allowed to start driving shortly thereafter, but this is by no means certain. Data on the reliability of current sensors is unavailable. No States are known to actively monitor data regarding BAIID failures -- even where there are laws or regulations that require the interlock service providers to report such data.

There is anecdotal evidence that substantial numbers of interlock users have complained about erroneous readings, but the complaints have apparently not been investigated. An analyst who has examined large numbers of interlock data records notes that there are suspiciously high numbers of instances in which BrAC readings taken only a few minutes apart show substantial differences. These could be caused by hardware problems or by persons other than the driver providing the samples. Instances often occur in morning daylight hours with an initial reading of .04 or .05 followed by a passing reading. This is suggestive of a driver who was drinking the night before, and asks another family member to blow a passing sample so that the person can drive to work. Current fuel-cell sensors are known to exhibit some drift in response -- about 1 percent of the reading per month, requiring frequent replacement of the sensor with a freshly calibrated unit.

Service providers would like to increase the recalibration interval to reduce costs and inconvenience, but the feasibility is still debatable. A related issue is quality control in recalibration operations. Some vendors perform all recalibration in a central laboratory, while others do it in their local service centers. Anecdotal reports suggest that some of the local personnel do not follow appropriate procedures. Contamination of sensors is another problem, but again there is no available data about its incidence. These failures may cause the unit to issue a lockout warning, meaning that the vehicle must be returned to a service center within seven days for a repair. There is no charge for such a visit, but it is an obvious inconvenience to the users. Under the current certification process for interlocks, manufacturers are required to have

30 separate tests performed on a given product, as detailed in Model Specifications for Breath Alcohol Ignition Interlock Devices.[Ref. - 14] However, the States require only that vendors submit letters attesting that products have passed all of the tests performed by independent labs. This is in contrast to the more reliable practice of requiring copies of the independent test lab reports, which must then be examined by the staff of the entity requiring the certification. It has been alleged that some interlocks currently in use do not actually meet all of the requirements. Their manufacturers have had various samples tested by different labs. Some samples passed some criteria at one lab, some at another, and some at a third. Collectively, the samples passed all of the tests at least once at a lab, but no single sample passed all of the tests.

Furthermore, it is alleged that there have been numerous instances in which the design of products has changed, but model numbers are not retained. Therefore, there remains some doubt about the accuracy, reliability, and durability of current BAIIDs. Current interlocks are designed to enforce a zero-tolerance policy for DUI offenders driving after drinking which, in part, is a way to account for the error band surrounding a BAIID measurement. For comparison, evidential grade fuel cell monitors have a standard error of about +/- .015. It is safe to assume that the error for interlock sensors is higher, because they are built to sell at much lower prices and because the interval between calibrations is much longer.

CHAPTER-8

CONCLUSION

Thus a design to efficiently check drunken driving has been developed. By implementing this design a safe car journey is possible decreasing the accident rate due to drinking. By implementing this design drunken drivers can be controlled so are the accidents due to drunken driving. Government must enforce laws to install such circuit is every car which are already on road and must regulate all car companies to preinstall such mechanisms while manufacturing the car itself. If this is achieved the deaths due to drunken drivers can be brought to zero percent.

CHAPTER-9

FUTURE SCOPE

The new technology, known as the Driver Alcohol Detection Systems for Safety, would use sensors that would measure blood alcohol content of the driver in two possible ways, by analysing a driver's breath or through the skin, using sophisticated touch-based sensors situated in places like steering wheels and door locks.

If the system detects the blood alcohol content in a person to be above the legal limit of .08, the vehicle would not start. The technology, being developed by research and development facility QinetiQ North America Inc in conjunction with companies in Sweden and New Mexico, would be optional for car manufacturers.

QinetiQ engineers said that unlike court-ordered breath-analyser ignition locks, which require a driver to blow into a tube and wait a few seconds for the result, their systems will analyse a driver's blood-alcohol content in less than one second.

The project was set up in 2008 with a grant of USD 10 million from the National Highway Traffic Safety Administration and the Automotive Coalition for Traffic Safety, an industry group representing many of the world's car makers. It ends in 2013. The first working prototypes of the systems were demonstrated at an event attended by US Transportation Secretary Ray LaHood.

National Highway Traffic Safety Administration head David Strickland said the technology could help prevent as many as 9,000 alcohol-related fatalities a year in the US. He added that the technology was still in its early stages of testing and might not be available for commercial use for another 8-10 years.The systems would not be employed unless they are “seamless, unobtrusive and unfailingly accurate,” Strickland said.

9.1 STRATEGIES AND GOALS OF THE PRO-INTERLOCK MOVEMENT

DADSS 5-Year Plan

DADSS has a 5-year plan for the development of alcohol detection technology. In Phase 1, a proof-of-principle prototype will be completed. Phase 1 began in January 2009 and will last for one year. In Phase 2, a demonstration vehicle will be developed over a 3-year period.

THE SWEDEN STRATEGY

Interlock advocates have a step-by-step strategy to make the use of interlocks widespread in Sweden, using a playbook that could be replicated in other countries. This “Sweden Strategy” seeks laws by 2010 that would make interlocks a mandatory condition for driving again after one DUI conviction. Concurrently, the strategy calls for placing interlocks in all professional trucks immediately and in all professional buses starting in 2010. After gradually introducing interlocks in public transport, the strategy calls for requiring interlocks in all new cars. A Swedish government minister has already stated that the Swedish government wants all new cars to have interlocks by 2012.

9.2 THE ROAD AHEAD

DADSS, MADD, and other groups continue to push forward with interlock advocacy and further development of alcohol detection technology. Car companies like Volvo, Saab, Nissan, and Toyota have partnered with interlock advocates and begun researching, developing and promoting their own interlock devices. Each year, millions of dollars are put towards these ends. The International Alcohol Interlock Symposium brings together interlock supporters in the policy, advocacy, and technology fields. The annual conference, which will be held in Melbourne in 2009, highlights the successes advocates in each country have had with interlock laws and sheds light on public policy tactics and new technologies under development. The time it takes for technology to become widespread is shortening. Moore’s law states that growth in computer technology occurs exponentially. Analysts have applied Moore’s law to other technology fields, indicating that the time from technology’s development until it is widespread in society is getting shorter. Alcohol detection systems may follow a similar pattern as demand grows and use of such devices becomes more prevalent. As interlocks become more publicly acceptable and widespread, there may be an arms race as car companies and interlock manufacturers look to cash in on the new market. As New Mexico’s DWI Czar Rachel O’Conner said, “a race is on nationwide to create smart-car technology that both identifies drivers and determines if they’re drunk to respond accordingly.” Based on current and proposed technology, future cars could be capable of monitoring drivers’ BAC at any level. Sniffing devices in the cabin and seats could monitor the air, while touch-activated sensors embedded in the steering wheel and gear shift could scan drivers’ skin. And with wireless technology, the car’s devices could communicate with local authorities if anything undesirable about the driver is detected. Public polling already shows a base of support for interlock advocates to build on. DADSS and MADD will continue to look at and develop public support for mandatory, universal interlock use in Europe and North America.

CHAPTER-10

BIBLIOGRAPHY

1. Traffic Safety Facts 2004: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System. 2005. National Center for Statistics and Analysis. Washington, DC: National Highway Traffic Safety Administration.
2. Peters, B., & van Winsum, W., SAVE: System for Effective Assessment of the Driver State and Vehicle Control in Emergency Situations. 1998. R&D Program Telematics: EU.
3. 4. Liu, C., Chen, C. S., Subramanian, R., & Utter, D., Analysis of Speeding-Related Fatal Motor Vehicle Crashes. 2005. Washington, DC: National Highway Traffic Safety Administration.
4. 5. Fell, J. C. Potential Role of Technology in Reducing Alcohol-Related Traffic Fatalities, in International Technology Symposium: A Nation Without Drunk Driving. 2006. Albuquerque, New Mexico: MADD.
5. Grant, B. F., & Dawson, D. A., Introduction to the National Epidemiologic Survey on Alcohol andRelated Conditions, National Institute on Alcohol Abuse and Alcoholism.
6. Williams, A. F., Alcohol-Impaired Driving and its Consequences in the United States: The Past 25Years. Journal of Safety Research, 2006.
7. NHTSA, Initiatives to Address Impaired Driving. 2003. Washington, DC: National Highway Traffic Safety Administration.
8. NHTSA, National Survey of Drinking and Driving Attitudes and Behaviors, 2001. 2003. Washington, DC: National Highway Traffic Safety Administration.
9. Subramanian, R., Total and Alcohol-Related Fatality Rates by State, 2003-2004. 2006.National Center for Statistics and Analysis. Washington, DC: National Highway Traffic Safety Administration.
10. Peck, R. C., Arstein-Kerslake, G. W., &Helander, C. J. (1994). Psychometric and biographical correlates of drunk-driving recidivism and treatment programs compliance. Journal of Studies on Alcohol.
11. Rauch, W. J., Berlin, M., & Ahlin, E. M. (2000). A review of state ignition interlock laws, administrative regulations, and policy practices for potential legal barriers to implementation of state ignition interlock programs. Alcoholism: Clinical and Experimental Research.

12. Simon, S. M. (1992). Incapacitation alternatives for repeat DWI offenders. Alcohol,Drugs and Driving 8, 51–60.
13. Voas , R., Blackman, K., Tippetts, S., Marques, P.R. (2001). Motivating DUI offendersto install interlocks: Avoiding jail as an incentive. In Press. Accident Analysis and Prevention
14. Federal Register, Model Specifications for Breath Alcohol Ignition Interlock Devices. 1992. p. 11774-11787.

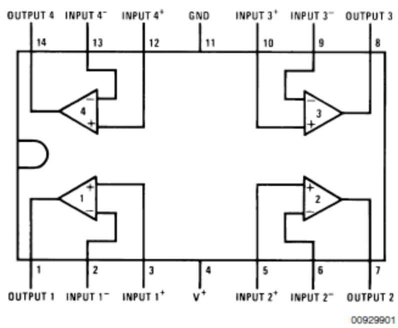
APPENDIX

1. Data sheet of LM324 quad op amp IC
2. Data sheet of 74LS00 NAND gate IC
3. Data sheet of MQ-3 alcohol detector

APPENDIX - 1

CONNECTION DIAGRAMS:

Dual-In-Line Package

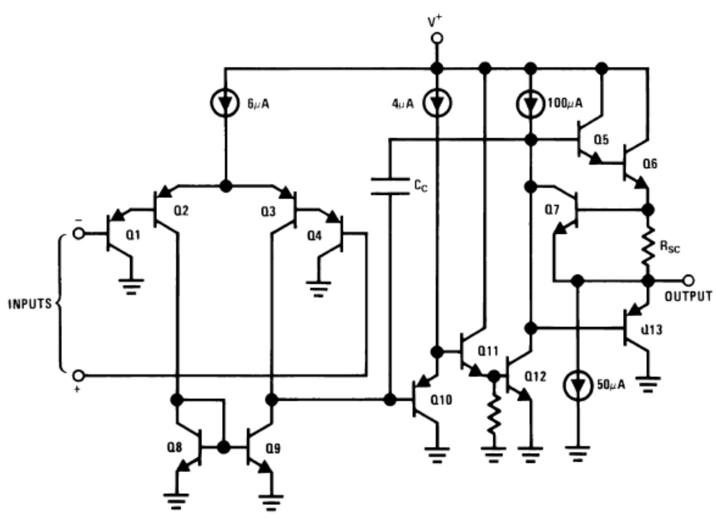


Top View

Order Number LM124J, LM124AJ, LM124J/883 (Note 2), **LM124AJ/883** (Note 1), **LM224J, LM224AJ, LM324J, LM324M, LM324MX, LM324AM, LM324AMX, LM2902M, LM2902MX, LM324N, LM324AN, LM324MT, LM324MTX or LM2902N LM124AJRQML and LM124AJRQMLV**(Note 3)

See NS Package Number J14A, M14A or N14A

SCHEMATIC DIAGRAMS:



ABSOLUTE MAXIMUM RATINGS:

	LM124/LM224/LM324 LM124A/LM224A/LM324A	LM2902
Supply Voltage, V^+	32V	26V
Differential Input Voltage	32V	26V
Input Voltage	−0.3V to +32V	−0.3V to +26V
Input Current		
(V_{IN} < −0.3V) (Note 6)	50 mA	50 mA
Power Dissipation (Note 4)		
Molded DIP	1130 mW	1130 mW
Cavity DIP	1260 mW	1260 mW
Small Outline Package	800 mW	800 mW
Output Short-Circuit to GND		
(One Amplifier) (Note 5)		
$V^+ \leq 15V$ and $T_A = 25°C$	Continuous	Continuous
Operating Temperature Range		−40°C to +85°C
LM324/LM324A	0°C to +70°C	
LM224/LM224A	−25°C to +85°C	
LM124/LM124A	−55°C to +125°C	
Storage Temperature Range	−65°C to +150°C	−65°C to +150°C
Lead Temperature (Soldering, 10 seconds)	260°C	260°C
Soldering Information		
Dual-In-Line Package		
Soldering (10 seconds)	260°C	260°C
Small Outline Package		
Vapor Phase (60 seconds)	215°C	215°C
Infrared (15 seconds)	220°C	220°C

ELECTRICAL CHARACTERISTICS:

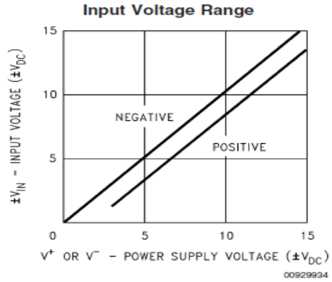
$V^+ = +5.0V$, (Note 7), unless otherwise stated

Parameter	Conditions	LM124A			LM224A			LM324A			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	(Note 8) $T_A = 25°C$		1	2		1	3		2	3	mV
Input Bias Current (Note 9)	$I_{IN(+)}$ or $I_{IN(-)}$, $V_{CM} = 0V$, $T_A = 25°C$		20	50		40	80		45	100	nA
Input Offset Current	$I_{IN(+)}$ or $I_{IN(-)}$, $V_{CM} = 0V$, $T_A = 25°C$		2	10		2	15		5	30	nA
Input Common-Mode Voltage Range (Note 10)	$V^+ = 30V$, (LM2902, $V^+ = 26V$), $T_A = 25°C$	0		V^+−1.5	0		V^+−1.5	0		V^+−1.5	V
Supply Current	Over Full Temperature Range $R_L = \infty$ On All Op Amps $V^+ = 30V$ (LM2902 $V^+ = 26V$) $V^+ = 5V$		1.5 0.7	3 1.2		1.5 0.7	3 1.2		1.5 0.7	3 1.2	mA
Large Signal Voltage Gain	$V^+ = 15V$, $R_L \geq 2k\Omega$, (V_O = 1V to 11V), $T_A = 25°C$	50	100		50	100		25	100		V/mV
Common-Mode	DC, V_{CM} = 0V to V^+ − 1.5V,	70	85		70	85		65	85		dB

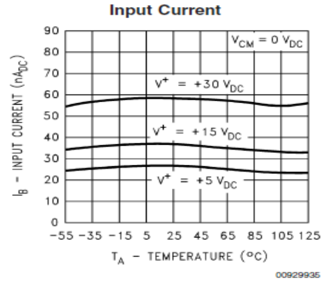
Parameter		Conditions		LM124A Min	LM124A Typ	LM124A Max	LM224A Min	LM224A Typ	LM224A Max	LM324A Min	LM324A Typ	LM324A Max	Units
Rejection Ratio		$T_A = 25^\circ C$											
Power Supply Rejection Ratio		$V^+ = 5V$ to $30V$ (LM2902, $V^+ = 5V$ to $26V$), $T_A = 25^\circ C$		65	100		65	100		65	100		dB
Amplifier-to-Amplifier Coupling (Note 11)		$f = 1$ kHz to 20 kHz, $T_A = 25^\circ C$ (Input Referred)			−120			−120			−120		dB
Output Current	Source	$V_{IN}^+ = 1V$, $V_{IN}^- = 0V$, $V^+ = 15V$, $V_O = 2V$, $T_A = 25^\circ C$		20	40		20	40		20	40		mA
	Sink	$V_{IN}^- = 1V$, $V_{IN}^+ = 0V$, $V^+ = 15V$, $V_O = 2V$, $T_A = 25^\circ C$		10	20		10	20		10	20		mA
		$V_{IN}^- = 1V$, $V_{IN}^+ = 0V$, $V^+ = 15V$, $V_O = 200$ mV, $T_A = 25^\circ C$		12	50		12	50		12	50		μA
Short Circuit to Ground		(Note 5) $V^+ = 15V$, $T_A = 25^\circ C$			40	60		40	60		40	60	mA
Input Offset Voltage		(Note 8)				4			4			5	mV
V_{OS} Drift		$R_S = 0\Omega$			7	20		7	20		7	30	μV/°C
Input Offset Current		$I_{IN(+)} - I_{IN(-)}$, $V_{CM} = 0V$				30			30			75	nA
I_{OS} Drift		$R_S = 0\Omega$			10	200		10	200		10	300	pA/°C
Input Bias Current		$I_{IN(+)}$ or $I_{IN(-)}$			40	100		40	100		40	200	nA
Input Common-Mode Voltage Range (Note 10)		$V^+ = +30V$ (LM2902, $V^+ = 26V$)		0		V^+-2	0		V^+-2	0		V^+-2	V
Large Signal Voltage Gain		$V^+ = +15V$ (V_OSwing = 1V to 11V) $R_L \geq 2$ kΩ		25			25			15			V/mV
Output Voltage Swing	V_{OH}	$V^+ = 30V$	$R_L = 2$ kΩ	26			26			26			V
		(LM2902, $V^+ = 26V$)	$R_L = 10$ kΩ	27	28		27	28		27	28		V
	V_{OL}	$V^+ = 5V$, $R_L = 10$ kΩ			5	20		5	20		5	20	mV
Output Current	Source	$V_O = 2V$	$V_{IN}^+ = +1V$, $V_{IN}^- = 0V$, $V^+ = 15V$	10	20		10	20		10	20		mA
	Sink		$V_{IN}^- = +1V$, $V_{IN}^+ = 0V$, $V^+ = 15V$	10	15		5	8		5	8		mA

TYPICAL PERFORMANCE CHARACTERISTICS:

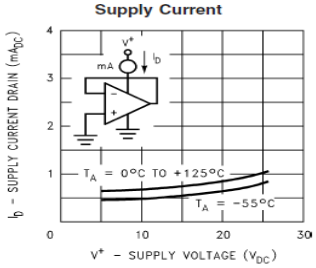
Input Voltage Range



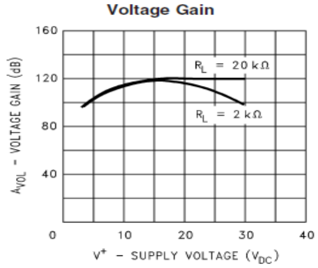
Input Current



Supply Current

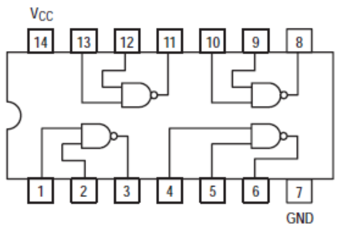


Voltage Gain



APPENDIX – 2

SCHEMATIC DIAGRAMS AND OPERATING RANGES:



Symbol	Parameter	Min	Typ	Max	Unit
V_{CC}	Supply Voltage	4.75	5.0	5.25	V
T_A	Operating Ambient Temperature Range	0	25	70	°C
I_{OH}	Output Current – High			–0.4	mA
I_{OL}	Output Current – Low			8.0	mA

DC CHARACTERISTICS:

Symbol	Parameter	Limits Min	Typ	Max	Unit	Test Conditions	
V_{IH}	Input HIGH Voltage	2.0			V	Guaranteed Input HIGH Voltage for All Inputs	
V_{IL}	Input LOW Voltage			0.8	V	Guaranteed Input LOW Voltage for All Inputs	
V_{IK}	Input Clamp Diode Voltage		–0.65	–1.5	V	V_{CC} = MIN, I_{IN} = –18 mA	
V_{OH}	Output HIGH Voltage	2.7	3.5		V	V_{CC} = MIN, I_{OH} = MAX, V_{IN} = V_{IH} or V_{IL} per Truth Table	
V_{OL}	Output LOW Voltage		0.25	0.4	V	I_{OL} = 4.0 mA	V_{CC} = V_{CC} MIN, V_{IN} = V_{IL} or V_{IH} per Truth Table
			0.35	0.5	V	I_{OL} = 8.0 mA	
I_{IH}	Input HIGH Current			20	µA	V_{CC} = MAX, V_{IN} = 2.7 V	
				0.1	mA	V_{CC} = MAX, V_{IN} = 7.0 V	
I_{IL}	Input LOW Current			–0.4	mA	V_{CC} = MAX, V_{IN} = 0.4 V	
I_{OS}	Short Circuit Current (Note 1)	–20		–100	mA	V_{CC} = MAX	
I_{CC}	Power Supply Current Total, Output HIGH			1.6	mA	V_{CC} = MAX	
	Total, Output LOW			4.4			

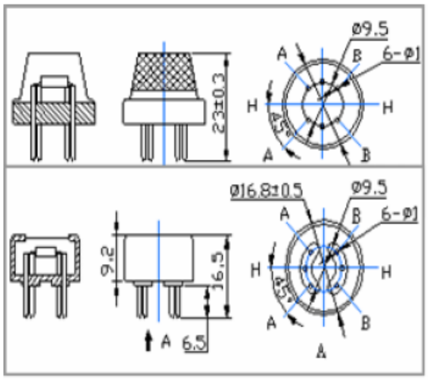
Note 1: Not more than one output should be shorted at a time, nor for more than 1 second.

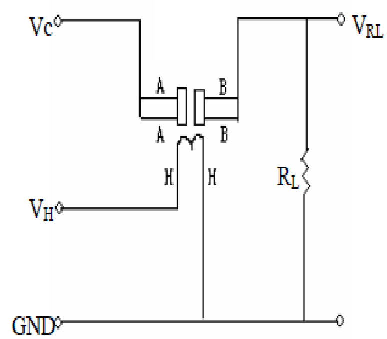
AC CHARACTERISTICS:

Symbol	Parameter	Limits Min	Typ	Max	Unit	Test Conditions
t_{PLH}	Turn–Off Delay, Input to Output		9.0	15	ns	V_{CC} = 5.0 V C_L = 15 pF
t_{PHL}	Turn–On Delay, Input to Output		10	15	ns	

APPENDIX - 3

CONFIGURATION:

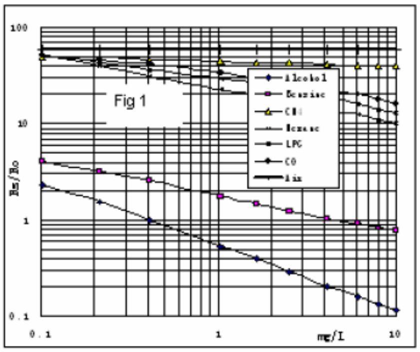




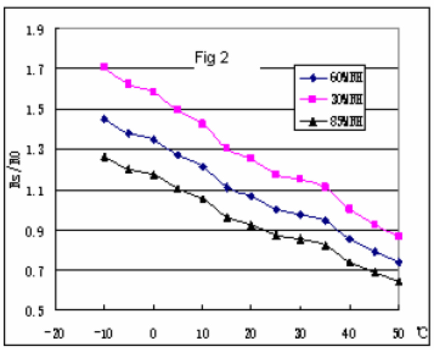
TECHNINCAL DATA:

Model No.			MQ-3
Sensor Type			Semiconductor
Standard Encapsulation			Bakelite (Black Bakelite)
Detection Gas			Alcohol gas
Concentration			0.04-4mg/l alcohol
Circuit	Loop Voltage	V_c	≤24V DC
	Heater Voltage	V_H	5.0V±0.2V AC or DC
	Load Resistance	R_L	Adjustable
Character	Heater Resistance	R_H	31Ω±3Ω（Room Tem.）
	Heater consumption	P_H	≤900mW
	Sensing Resistance	R_s	2KΩ-20KΩ(in 0.4mg/l alcohol)
	Sensitivity	S	Rs(in air)/Rs(0.4mg/L Alcohol)≥5
	Slope	α	≤0.6(R_{300ppm}/R_{100ppm} Alcohol)
Condition	Tem. Humidity		20℃±2℃；65%±5%RH
	Standard test circuit		Vc:5.0V±0.1V； V_H: 5.0V±0.1V
	Preheat time		Over 48 hours

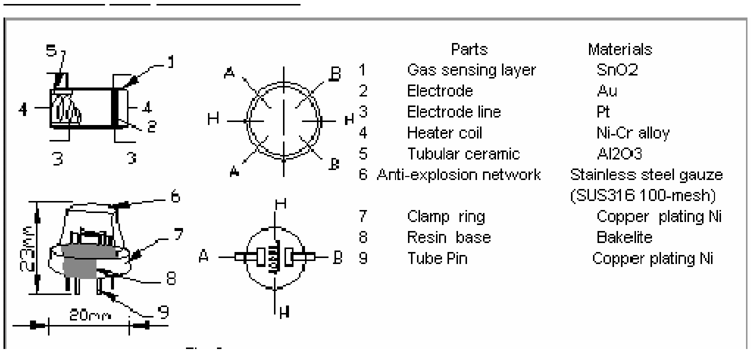
SENSITIVITY CHARACTERISTICS:



INFLUENCE OF TEMPERATURE/HUMIDITY:



STRUCTURE AND CONFIGURATION:



Structure and configuration of MQ-3 gas sensor is shown as aboveFig., sensor composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO_2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-4 have 6 pin, 4 of them are used to fetch signals, and other 2 are used for providing heating current.