

Integrated Drunken Driving Prevention System

T. Shyam Ramanath, A. Sudharsan, and A. Kavitha

Abstract—As is needless to say; a majority of accidents, which occur, are due to drunk driving. As such, there is no effective mechanism to prevent this. Here we have designed an integrated system for the same purpose. Alcohol content in the driver's body is detected by means of an infrared breath analyzer placed at the steering wheel. An infrared cell directs infrared energy through the sample and any unabsorbed energy at the other side is detected. The higher the concentration of ethanol, the more infrared absorption occurs (in much the same way that a sunglass lens absorbs visible light, alcohol absorbs infrared light). Thus the alcohol level of the driver is continuously monitored and calibrated on a scale. When it exceeds a particular limit the fuel supply is cutoff. If the device is removed also, the fuel supply will be automatically cut off or an alarm is sounded depending upon the requirement. This does not happen abruptly and special indicators are fixed at the back to avoid inconvenience to other drivers using the highway signals. Framework for integration of sensors and control module in a scalable multi-agent system is provided. A SMS which contains the current GPS location of the vehicle is sent via a GSM module to the police control room to alert the police. The system is foolproof and the driver cannot tamper with it easily. Thus it provides an effective and cost effective solution for the problem of drunk driving in vehicles.

Keywords—GSM (GLOBAL SYSTEM MONITORING), GPS(GLOBAL POSITIONING SYSTEM).

I. INTRODUCTION

INITIALLY we would like to display the U.S state department statistics regarding drunk driving[9].

- 1) 50% of all accidents, occurring, are due to drunk driving.
- 2) Each year, around 12,000 people die.
- 3) Every half a minute, 1 person dies due to drunken driving.

The graph shows the number of deaths in alcohol related crashes.

From these data, we can easily come to the conclusion that designing an efficient system to prevent drunk driving is of paramount importance. Till date, there are no systems, which are practically implementable. This new system can be easily fixed in existing vehicles and is very cost effective.

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II. THE BASIC COMPONENTS

- 1) An Infrared Light Generator.
- 2) An Infrared Sensor.
- 3) A Calibrated Scale.
- 4) An Automated Electromechanical Valve.
- 5) Toroidal Coil.
- 6) Variable Resistor.
- 7) Carburetor/Injection Pump.
- 8) A GPS Receiver.
- 9) A GSM Mobile.

TABLE I
DRUNK AND DRIVING ACCIDENTS STATISTICS

Year	Total Number Of Fatalities	Total Number Of Alcohol Related Fatalities
1990	44,599	22,587
1991	41,508	20,159
1992	39,250	18,290
1993	40,150	17,908
1994	40,716	17,308
1995	41,817	17,732
1996	42,065	17,749
1997	42,013	16,711
1998	41,501	16,673
1999	41,717	16,572
2000	41,945	17,380
2001	42,196	17,400
2002	43,005	17,524
2003	42,643	17,013
2004	43,443	16,885
2005	42,532	15,829
2006	43,518	15,543

III. INFRARED SPECTROSCOPY

The Infrared portion of the electromagnetic spectrum is divided into three regions; the near-, mid- and far- infrared, named for their relation to the visible spectrum[1]. The far-infrared, approximately $400\text{--}10\text{ cm}^{-1}$ ($1000\text{--}30\text{ }\mu\text{m}$), lying adjacent to the microwave region, has low energy and may be used for rotational spectroscopy. The mid-infrared, approximately $4000\text{--}400\text{ cm}^{-1}$ ($30\text{--}1.4\text{ }\mu\text{m}$) may be used to study the fundamental vibrations and associated rotational-vibration structure.

The higher energy near-IR, approximately $14000\text{--}4000\text{ cm}^{-1}$ ($1.4\text{--}0.8\text{ }\mu\text{m}$) can excite overtone or harmonic vibrations. The names and classifications of these sub regions are merely conventions. They are neither strict division nor based on exact molecular or electromagnetic properties.

Infrared spectroscopy exploits the fact that molecules have specific frequencies at which they rotate or vibrate corresponding to discrete energy levels. These resonant frequencies are determined by the shape of the molecular

potential energy surfaces, the masses of the atoms and, by the associated vibronic coupling. In order for a vibration mode in a molecule to be IR active, it must be associated with changes in the permanent dipole. In particular, in the Born-Oppenheimer and harmonic approximations, i.e. when the molecular Hamiltonian corresponding to the electronic ground state can be approximated by a harmonic oscillator in the neighborhood of the equilibrium molecular geometry, the resonant frequencies are determined by the normal modes corresponding to the molecular electronic ground state potential energy surface. Nevertheless, the resonant frequencies can be in a first approach related to the strength of the bond, and the mass of the atoms at either end of it. Thus, the frequency of the vibrations can be associated with a particular bond type.

Simple diatomic molecules have only one bond, which may stretch. More complex molecules have many bonds, and vibrations can be conjugated, leading to infrared absorptions at characteristic frequencies that may be related to chemical groups. For example, *the atoms in a CH₂ group*, commonly found in organic compounds can vibrate in six different ways: **symmetrical and antisymmetrical stretching, scissoring, rocking, wagging and twisting**. The infrared spectrum of a sample is collected by passing a beam of infrared light through the sample. Examination of the transmitted light reveals how much energy was absorbed at each wavelength. This can be done with a monochromatic beam, which changes in wavelength over time, or by using a Fourier transform instrument to measure all wavelengths at once. From this, a transmittance or absorbance spectrum can be produced, showing at which IR wavelengths the sample absorbs. Analysis of these absorption characteristics reveals details about the molecular structure of the sample. This technique works almost exclusively on samples with covalent bonds. Simple spectra are obtained from samples with few IR active bonds and high levels of purity. . More complex molecular structures lead to more absorption bands and more complex spectra. The technique has been used for the characterization of very complex mixture.

IV. IR TRANSMITTER AND RECEIVER

The infrared transmitter LD271H is a *GaAs infrared emitting diode*, fabricated in a liquid phase epitaxy process[8]. It is highly reliable and has a capability of high pulse handling.

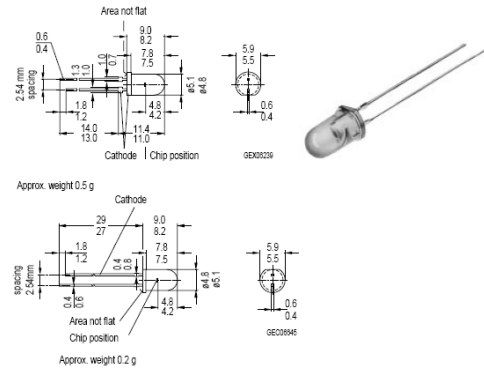


Fig. 1 Infrared Transmitter [LD271H]

The receiver used here is *PNA4602M*. It is usually used to absorb the equivalent amount of infrared rays emitted by the transmitter LD271H[8]. The maximum extension distance is 8m or more.

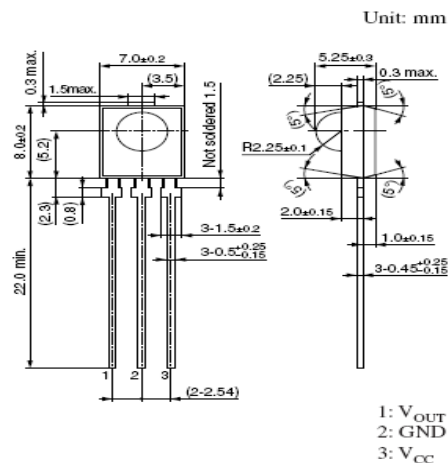


Fig. 2 Infrared Receiver [PNA4602M]

The operation of the transmitting and the receiving end can be clearly explained by the following block diagram.

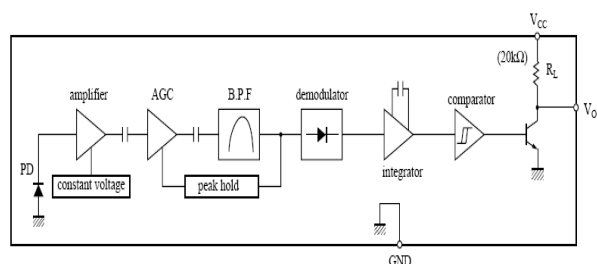


Fig. 4 Block Diagram Of Receiving Section of PNA4602M

V. THE ALCOHOL DETECTION MECHANISM

The infrared rays can be obtained with the help of ordinary infrared lamps. These have tungsten filament that can *withstand heat up to 3000 c* and they emit infrared light.

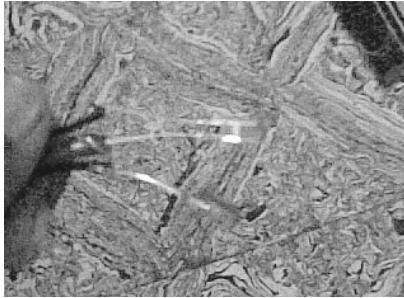


Fig. 5 Infrared Transmitter And Receiver

In case the driver is drunk there will be a certain amount of alcohol in his breathe. This *alcohol content in the breath will be relatively proportional to the amount of alcohol intake*. The alcohol in the vapor state has the property of absorbing infra red light.

The infrared light emitted passes through the air medium and reaches the sensor [PNA4602M], which *detects the loss of the infrared light due to the absorption of alcohol present in the surroundings*. This sensor then measures the loss by comparing the received amount of radiations with a fixed parameter that is predefined. The sensor is calibrated in such a way that the amount of loss is directly equal to the amount of alcohol present in the atmosphere. The *energy consumed by the IR system is very less*. Also the detection need not take place continuously. It can be done at discrete intervals.

V. POSITIONING OF THE DETECTION SYSTEM

One fact to be taken into consideration is that we are not concerned with the amount of alcohol intake of the other passengers in the car. Also the detection system must not be affected due to other extraneous elements [example: in case the vehicle passes near a wine shop]. So the *sensitivity of the system must be limited to a very small distance*.

The emitter and detector are placed on the steering wheel of the vehicle. The breath of the driver necessarily passes through the air gap between the infrared emitter and detector. So, the alcohol content is precisely noted.

VI. CUTTING OFF THE FUEL SUPPLY

Once the drunken driving case is detected, and then an automatic signal is generated and sent to the actuator[5]. This controls the working of a valve, which controls the supply of the fuel.

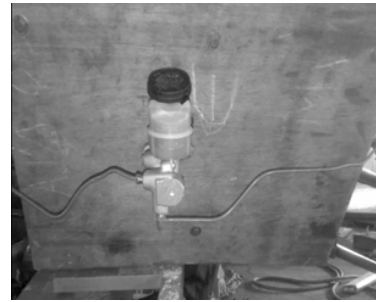


FIG. 6 ELECTRO MECHANICAL VALVE

This *valve can be in only one of two states*. It is open or it is closed. So, the fuel supply can be cutoff when required. An important point to be taken into consideration is that the vehicle does not stop abruptly. Once the valve is closed, the vehicle slows down and finally comes to a stopping position.

IV. PRECAUTIONARY INDICATORS

An important point to be taken into consideration is that the vehicle does not stop abruptly. Once the valve is closed, the vehicle slows down and finally comes to a stop. As the vehicle slows down, two special green indicator lights are turned on at the rear end of the vehicle so that the driver of the next vehicle can realize it and act accordingly[3]. Thus even a minute chance for a possible collision due to this system does not exist. So, it is completely safe.

VIII. THE ALTERNATIVE METHOD

Some may argue that cutting off the fuel supply may pose a safety threat. That is because in this case the driver of the vehicle is compelled to bring his vehicle to a stop.

So as an alternative, we propose another strategy. In this method, once the alcohol content is detected to be above a particular level, then an alarm is automatically triggered. This alerts the authorities and the passer by and the driver is forced to bring his vehicle to a stop.

Ideally, for the normal vehicles, the second alternative is sufficient. In the case of repeat offenders who are more prone to drunk driving, the more stringent alternative of cutting the fuel supply may be used.

IX. THE BIGGEST ADVANTAGE

The advantage of the system is that the driver cannot even tamper with it. Because the fuel supply valve is open only when all the components are working properly and the IR light detected is comparable to the standard value. So, if anyone tampers with it or if the alcohol content is above a particular limit, fuel is not supplied and the vehicle cannot be started.

X. DATA PUSHER

The data pusher is a combination of a GPS receiver and a GSM mobile. The GSM mobile to be used here is very basic, as it is only required to send a pre-stored message to a pre-stored police control tower GSM number. ***A single battery powers the entire system and the power consumption is minimal.***

A. Activation Of Data Pusher

The GPS receiver need not receive its data continuously because this data is not needed. When the infrared detector detects that the alcohol level is above a particular limit, then a message has to be sent to the police control tower regarding this and also the location of the vehicle has to be sent.

So once the infrared detector detects a case of drunk driving, then the data pusher system is automatically switched on. The GPS receiver immediately receives the physical coordinates of the location. This information along with the message "*Drunken Driving*" is sent via the GSM network as a text message by the GSM mobile to a pre-stored police control tower mobile number.

B Control Tower

The control tower can be a common tower for a wide jurisdictional area. Once this message is received by the control tower, and then the police force in the location near to the vehicle position is to be alerted by the control tower workforce. This alert can be either automated or manual. So, the culprit and the vehicle can be traced easily.

XI. FURTHER APPLICATIONS

- 1) To **develop a system for speed control and to integrate it with this system.**
- 2) To connect a GPS puller so that the position of the vehicle can be monitored round the clock and can be taken as and when needed.
- 3) To integrate it with a biometrics based anti-theft system.
- 4) To **implement urban traffic assistant (UTA).**

XII. CONCLUSIONS

The virtues of this project include various features like

- 1) Ingenuity
- 2) Simplicity of design
- 3) Easy implementation

It is completely integrated so that once it is implemented in all vehicles, then it will be impossible for drunk people to drive vehicles without being traced immediately.

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