International Journal For Recent Developments in Science & Technology
2581-4575
Crossref
A Peer Reviewed Research Journal

ALCOHOL ANALYSER

K. Rajesh[1], MD. Israfil[1], R. Naveen[1], B. Sai Ram[1], Ch. Rajini[2]

[1,2]Department of Electrical and Electronics Engineering

[1,2] Kommuri Pratap Reddy Institute of Technology, Ghatkesar, Hyderabad.

ABSTRACT

In this project, we have designed Alcohol Level Meter using Arduino & MQ-3 Alcohol Sensor for measuring the level of alcohol in humans breathes. Simply we have interfaced MQ-3 Alcohol Sensor module with Arduino and 16*2 LCD modules for display. The alcohol sensor we used is the MQ-3 sensor. This is a sensor that is not only sensitive to alcohol, particularly ethanol, which is the type of alcohol that is found in wine, beer, and liquor. The MQ-3 is still fun to play with, and maybe it's good enough to just make some LEDs light up when you blow on the sensor. Depending of the quantity of alcohol, it shows the LED indication depending on the percentage. If high alcohol consumed it shows RED LED with buzzer alert. If moderate alcohol it shows yellow, else it's indicated green led. This alcohol content gives a good indication for if a person is drunk and how drunk they are. This is good gadget for detection of drunk and drive easily.

Keywords: Alcohol level meter, Arduino, MQ-3 sensor.

1. INTRODUCTION

Alcohol breath testing on a larger scale will save lives. Alcohol intake affects the human body by significantly longer response time to external stimuli. In demanding situations where the senses need to be on alert a prolonged reaction time can be the difference between life and death, both for the intoxicated subject and for surrounding individuals. The aims of this thesis include investigations of a new type of breath alcohol sensor, designed for operation without a mouthpiece, both with regards to sensor performance as well as usability in relation to various breath alcohol screening applications. In many situations where breath alcohol screening is suitable, there is a need for quick and easy use. The instrument should interfere as little as possible with the regular routines and procedures. One such task is driving. To accommodate for these needs in an in-vehicle application, the breath alcohol sensing system must be seamlessly installed in the vehicle and not interfere with the normal behaviour of the sober driver. Driving is also a task requiring high level of concentration over a prolonged period of time. In the U.S. alone thousands of lives are annually lost in accidents where the driver was under the influence of alcohol. Similar numbers have been recorded for Europe. The potential for a system handling the needs for ease-of-use is huge and may result in successful products. The results presented within this thesis provide experimental evidence of sufficient sensor performance for screening applications with an instrument operating without a mouthpiece.

Smarter calculation methods were also shown to be a feasible path to improved measurement reliability. Important steps towards an even more passive solution for in-vehicle screening are also presented. Experiments showed that given enough time and sensor resolution, passive alcohol detection systems are feasible.

The method showed promising results allowing for continued development of user-friendly breath alcohol interlocks. Sense air AB was involved at an early stage contributing greatly with a strong background in gas sensor technology and high-volume IR-sensor manufacturing. For several years the research and development effort were conducted as a collaboration between Autoliv, H¨ok Instrument and Sense air. The progress made in the project attracted international attention and support has been received from an American public and private partnership. The National Highway Traffic Safety Administration (NHTSA) and the Automotive Coalition for Traffic Safety (ACTS) together 2 have undertaken the task to encourage new technology research to eliminate drunk driving on American roads. The partnership is called the Driver Alcohol Detection System for Safety (DADSS) program. Within the program there is a strong belief that if a system is to be accepted by the public, even by people who do not drink and drive, the determination of breath alcohol needs to be performed without any extensive action by the user. The system also needs to be accurate, fast, reliable, durable and maintenance free [8]. The system should not inconvenience the sober driver. The program has been a driving force to reach the extreme resolution required by such a system and the highly set goals for unobtrusive alcohol determination. The aim of this thesis is to further investigate the technology with the focus to push the boundaries in terms of ease-of-use in relation to breath alcohol sensing. My presented work includes investigation of sensor performance, human subject's studies and in-vehicle investigations. The lion share of the work has been focused on breath alcohol analysis in a vehicle environment. However, there are many important areas where the technology can be applied. Safety critical tasks are performed every day at airports, building sites, power plants, etc. Mass screening in such environments has the potential to minimize risk and save lives. The data collected during rigorous tests has been analyzed in relation to various potential products in mind. The starting point was a hand-held device capable of measuring exhalations at a distance of a few centimetres. Throughout the studies the investigated distance between the mouth and device increased, and with that an increased dilution. As the dilution increases so does the demand for higher resolution. In a vehicle environment, the goal is to achieve a system capable of detecting breath alcohol from an intoxicated driver without active human interaction. Translated to the application, it means capability to measure tidal breathing at approximately 65 cm.

Most ethanol, approximately 95%, in the body is removed through one out of three possible enzyme catalyzed processes. In all three processes, ethanol is metabolized into acetate via the intermediate acetaldehyde. The main pathway of the metabolism accounts for approx. 94% of the ingested ethanol uses the enzyme alcohol dehydrogenase, an enzyme abundant in liver cells, to metabolize ethanol to acetaldehyde. By the assistance of aldehyde dehydrogenase acetaldehyde is I turn metabolized into acetate, which enters the normal metabolism with CO2 and H2O as the end products. Less than 0.1% of the dosed ethanol metabolizes anaerobic to form ethyl glucuronid and ethyl sulfate. These substances can be found in urine after drinking. The rest of the ethanol, approximately 5%, is excreted form the body unchanged in breath, sweat and urine. Typical ethanol time profiles. Ethanol, when consumed, is consumed in large quantities compared to other impairing substances. The main pathway for the body to eliminate the substance is through enzyme catalysed reactions. This leads to saturation of the involved enzymes. The reaction therefore follows a linear curve until the concentration of ethanol is low enough to no longer occupy every available enzymatic space. At this point the elimination no longer appears linear, but instead shows a non-linear time curve. The transition occurs at ethanol concentrations as low as 0.01-0.02 g/L in blood. Even though the elimination more closely follows M-M kinetics [15], most forensic calculations of blood ethanol utilize the linear appearance of the saturated elimination reaction.

2. LITERATURE SURVEY

Alcohol impaired driving increases the risk of traffic accidents dramatically. In fact, the risk of being in an accident increases exponentially with the degree of intoxication [1, 2]. 145 drivers lost their lives on Swedish roads in 2012. Out of these 18% proved to be alcohol related [3]. The number increased slightly in 2016 to 152 fatalities with 22% of these proven to be under the influence of alcohol [4]. In the U.S. the number of accidents with fatal outcome involving alcohol impaired drivers was 10265 in 2015; this represented 29% of all traffic related deaths [5]. The current state of the art breath alcohol analysers demand delivery of a forced expiration with a mouthpiece. In everyday use where time and effort need to be minimized, e.g., vehicle and high through-put applications, the mouthpiece is a limiting factor. Therefore, there is a need for technological advancements to address the challenges for ease-of-use while maintaining the reliability of the measurement. As a result of an industrial partnership between Autoliv, Imego and H¨ok Instument AB, a method for effortless breath alcohol determination was proposed by H¨ok et al. in 2006 [6]. The method is because CO2 is produced in the human body via cellular respiration and in an exhalation the variation in CO2 concentration is sufficiently low between individuals and breaths. CO2 can therefore be used as a tracer gas to account for the dilution of a breath sample. The viability of CO2 as a tracer gas was studied by Kaisdotter Andersson, which resulted in a PhD thesis in 2010 [7]. Scientific research on breath alcohol in relation to overconsumption of alcohol dates back to 1874 when Anstie published his final experiments on the elimination of alcohol from the body. Anstie showed that only a fraction of the consumed alcohol could be recovered in the breath. In the 1930s blood alcohol concentration studies were performed by Erik Waymark in Sweden when he established concentration-time profiles of ethanol [8]. Liljestrand and Linde shortly thereafter found high correlation between bloods and breathe ethanol concentration and determined a constant blood: breath ratio of 2000:1. They also reported a time dependency of the blood-to-breath ratio depending on the time after drinking [9]. At first, legal limits were only set for blood alcohol concentrations causing a prolonged debate regarding an accurate conversion factor. However, due to the time dependence between blood and breath alcohol, most countries nowadays utilize one limit for blood alcohol and one for breath alcohol [10]. The first breath alcohol measurement device for use by law enforcement was invented and designed by Robert Borkenstein at Indiana University in 1954 [11]. He 5 utilized an oxidation/reduction wet chemistry reaction between alcohol and potassium dichromate to measure the absorption difference with UV spectroscopy [12]. Drunk driving - with varying success. Sweden was in fact able to present one of the few success stories, due to the important rehabilitation activities that were linked to the actual use of alcohol interlocks. The most important contribution to the development of alcohol interlocks was in use for quality assurance of transport services. Pioneering work was performed by the Swedish Road Administration in collaboration with a number of visionary companies in the transport sector. Within a few years, a de facto standard was established [13]. Alcohol affects almost all organs in the human body. The most pronounced effects when performing a complex task, e.g. driving, are related to the central nervous system. Alcohol impairs several important physiological functions, including vision and reaction time [14]. Alcohol also interferes with the ability to see objects at greater distance, diminish peripheral vision and impairs feature extraction in low light conditions. Apart from identifying a potential risk, the brain also has to decide how to avoid an imminent accident and a response signal has to be sent through the nerves to the muscles [15]. Alcohol delays each step in the signaling sequence and as a result the response time will increase. The risk increase due to alcohol impaired driving has been studied on several occasions, [16]. The studies are unanimous in that the risk of being in a car accident is increasing with the amount of alcohol in the body. The risk increase follows an exponential pattern versus the level of intoxication. The effects of alcohol start at very low concentrations, but a profound risk increase will not occur until reaching higher alcohol concentrations in the body [17].

3. PROPOSED SYSTEM

Our proposed work consists of various units that make up the system: the power supply unit, the Alcohol detection unit, display unit, alarm unit and indicating unit. An LCD display will be fitted inside the campus. The ATmega328 microcontroller under the brand name of Arduino Uno will be used to keep looking for the output from the Alcohol sensor MQ3 sensor. The Arduino Uno sketch which is the environment for programming is used to write the code, compile, generate hex file and load it to the microcontroller.

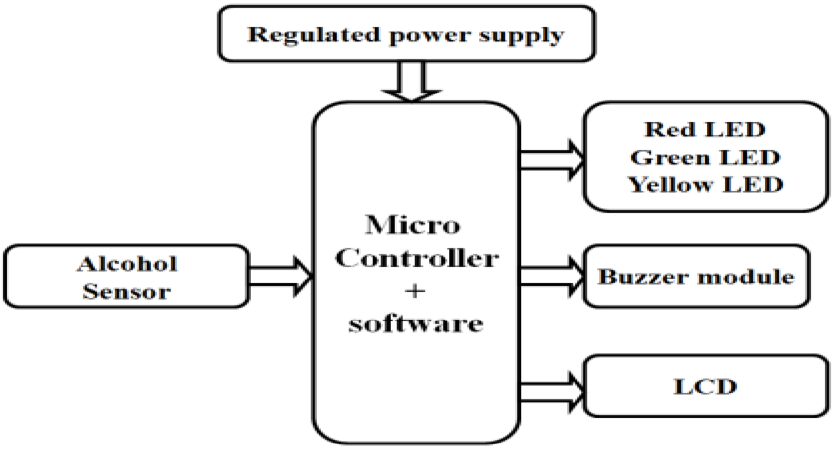

Fig. 1: Block diagram of proposed system.

The system proposes a design to fit monitoring applications on smartphones. Sensors positioned at planned locations sense the level of carbon monoxide, nitrous oxide, in the air. It provides simple access to the users to supervise real time air quality in their vicinity. It uses cost-effective and readily accessible devices such as an Alcohol quantity by MQ-3 sensor. Microcontrollers are used at the sensor node for supervising these sensors. In the cloud, the data analysis is done so that the society takes measures to Alcohol.

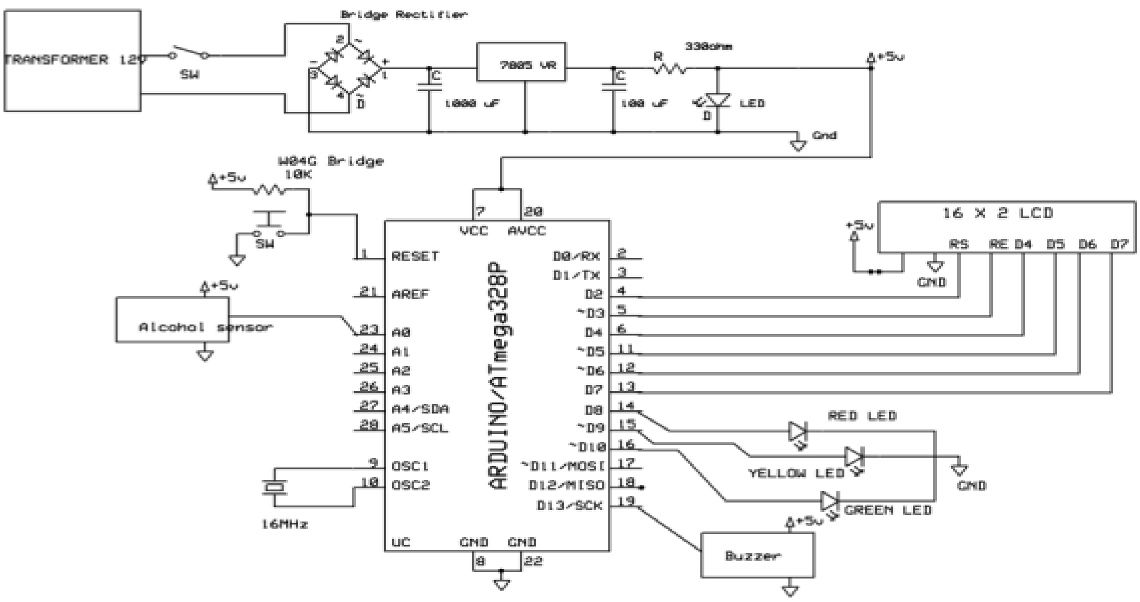

Fig. 2: Schematic diagram of proposed system.

2581-4575
International Journal For Recent Developments in Science & Technology
Crossref
A Peer Reviewed Research Journal

MQ3 Alcohol sensor will continuously monitor the Alcohol level and gives to the arguing controller. If the Alcohol level is very low then controller indicate with green LED. If the Alcohol level is medium then controller indicate with yellow LED. If the Alcohol level is very high then controller indicate with RED LED with buzzer alarm.

4. RESULTS

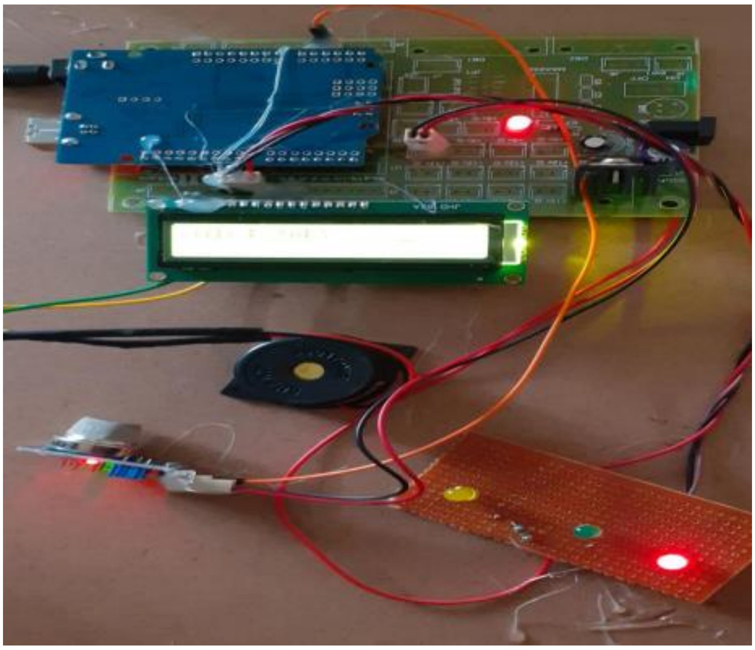

Fig. 3: Alcohol analyzer kit.

Hence by this kit alcohol percentage is detected on the display with the rated percentage.

5. CONCLUSION

In the proposed system we designed and implemented Alcohol monitoring system could be monitored in an environment without any constraint since the change in Alcohol concentration is only observed after a certain time and therefore it is not necessary for the system to keep values all the time. If the Alcohol level is very low then controller indicate with green LED. If the Alcohol level is medium then controller indicate with yellow LED. If the Alcohol level is very high then controller indicate with RED LED with buzzer alarm.

REFERENCES

[1] Pacific Northwest National Laboratory. Vapor phase infrared spectral library. https://secure2.pnl.gov/nsd/nsd.nsf/Welcome, 2015. [Online; accessed 01-Sept-2015].

[2] R D Blomberg, R C Peck, M Burns, and D Fiorentino. Crash risk of alcohol involved driving: A case-control study. Technical report, Dunlap & Associates Inc., Stamford CT, 2005.

[3] B Saxton. Road traffic injuries 2012. Technical report, Swedish Governmental Agency Transport Analysis, Link¨oping, Sweden, 2013.

[4] M Melkersson and S Bengtsson. Road traffic injuries 2016. Technical report, Swedish Governmental Agency Transport Analysis, Link¨oping, Sweden, 2017.

[5] National Center for Statistics and Analysis. Alcohol-impaired driving: 2015 data. Technical report, National Highway Traffic Safety Administration, Washington DC, 2016.

International Journal For Recent Developments in Science & Technology
2581-4575
Crossref
A Peer Reviewed Research Journal

[6] B H¨ok, H Pettersson, and G Andersson. Contactless measurement of breath alcohol. In Micro Structure Workshop, 2006.
[7] A Kaisdotter Andersson. Improved Breath Alcohol Analysis with use of Carbon Dioxide as the Tracer Gas. PhD thesis, M¨alardalen University, V¨aster˚as, Sweden, 2010.
[8] A Zaouk, M Willis, E Traube, and R Strassburger. Driver alcohol detection system for safety - a status update. In The 24th International Technical Conference on the Enhanched Safety of Vehicles, 2015.
[9] B. Ver Steeg T. Ridder and B. Laaksonen. Comparison of spectroscopically measured tissue alcohol concentration to blood and breathe alcohol measurements. Journal of Biomedical Optics, 14, 2009.
[10] B. Ver Steeg T. Ridder, E. Hull and B. Laaksonen. Comparison of spectroscopically measured finger and forearm tissue ethanol concentration to blood and breathe alcohol measurements. Journal of Biomedical Optics, 16, 2011.
[11] J C Gariott. Garriott's Medicolegal Aspects of Alcohol. Lawyers & Judges Publishing Company, Tucson AZ, 5 edition, 2008.
[12] G Liljestrand and P Linde. Uber die ausscheidung des alkohols mit der expirationsluft. Skandinavisches Archiv fur Physiologie, 80:273– 298, 1930.
[13] R F Borkenstein and H W Smith. The breathalyzer and its applications. Med. Sci Law, 2:13– 22, 1961.
[14] R F Borkenstein. The role of the drinking driver in traffic accidents. Indiana University, 1964.
[15] J G Wagner, P K Wilkinson, A J Sedman, D R Kay, and D J Weidler. Elimination of alcohol from human blood. Journal of Pharmaceutical Sciences, 65, 1976.
[16] A W Jones. Physiological aspects of breath-alcohol measurement. Alcohol, Drugs and Driving, 6, 1990.
[17] M P Hlastala. The alcohol breath test—a review. Journal of Applied Physiology, 84, 1998