SMART DRUNKEN DRIVER DETECTION AND SPEED MONITORING SYSTEM FOR VEHICLES

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ABSTRACT

The paper presents a new approach towards automobile safety and security to decrease the number of accidents caused due to the drunken drivers. It has a smart electronic system which continuously monitors the alcohol content in the air surrounding by the body of the protagonist. Speed of the vehicle varies on the content of alcohol detected. Vehicle based countermeasure system progressively monitors the speed locking system of the vehicle running from high (100kmph), medium (60-80kmph) and low (40kmph) which helps the driver to reach destination safely. In extreme situations the system disables the vehicle by switching off the ignition. The Global Positioning System (GPS) captures the location and sends information to the authorities with the help of a Global System for Mobile (GSM) device with the onetime password. Only after the password is entered the vehicle can be restarted. In the back end, all the riding circumstances, amount of alcohol detected, vehicle speed and the location is uploaded into web server automatically and accurately as soon as the sign of alcohol detected for investigation purpose. All the functions in the project are carried out with the help of ARM 7 based LPC 2148 microcontroller.

Keywords: Alcohol Detector, Communication Interface, Microcontroller, PAS 32U, Speed Lock.

I INTRODUCTION

Today every country is facing serious problem with drunken drivers. Every year deaths caused due to this problem follows upward graph. The European Union has recognized drunken driving, as a priority area, due to the fact that the loss due to death alone is 10,000 [1] of the GDP of EU. In USA due to the drink and driving every year 1,393 people are dying, which meant nearly four fatalities every day of the year [2]. In India every year nearly 130,000 people are being killed in drink and driving road accidents, overtaking China and now have the worst road traffic accident rate worldwide [3]. According to World Health Organization (WHO) report, 70% of total road fatalities are caused under the influence of alcohol. In India alone the death toll rose to 14 per every hour. The risk of a driver under the influence of alcohol being killed is at least eleven times [4] that of a person with no alcohol. The statistics of death rate is shown in the Fig 1 [5].

T. Karthik has proposed a perspiration based drunken driver detection system, a way of detecting the presence of alcohol in the driver body by using perspiration analysis [6]. They proposed to detect drunken driving by the process of infrared analysis of driver's sweat for detection of ethanol. The basis for this technique is the measurement of Blood Alcohol Concentration (BAC). Blood Alcohol content is usually expressed as a percentage defined by amount of alcohol present in the blood. It is a commonly known fact that a person

perspires more when he has just consumed alcohol as alcohol has a tendency to dilate the vessels in the skin. For this purpose, sensors are to be mounted on the steering wheel and analysis is carried out periodically. A perspiration analyzer is mounted on the steering wheel along with a heating element which is incorporated to induce perspiration of the palms. The absorption of IR having wave number 2000-3000cm indicates alcohol content in blood [6].

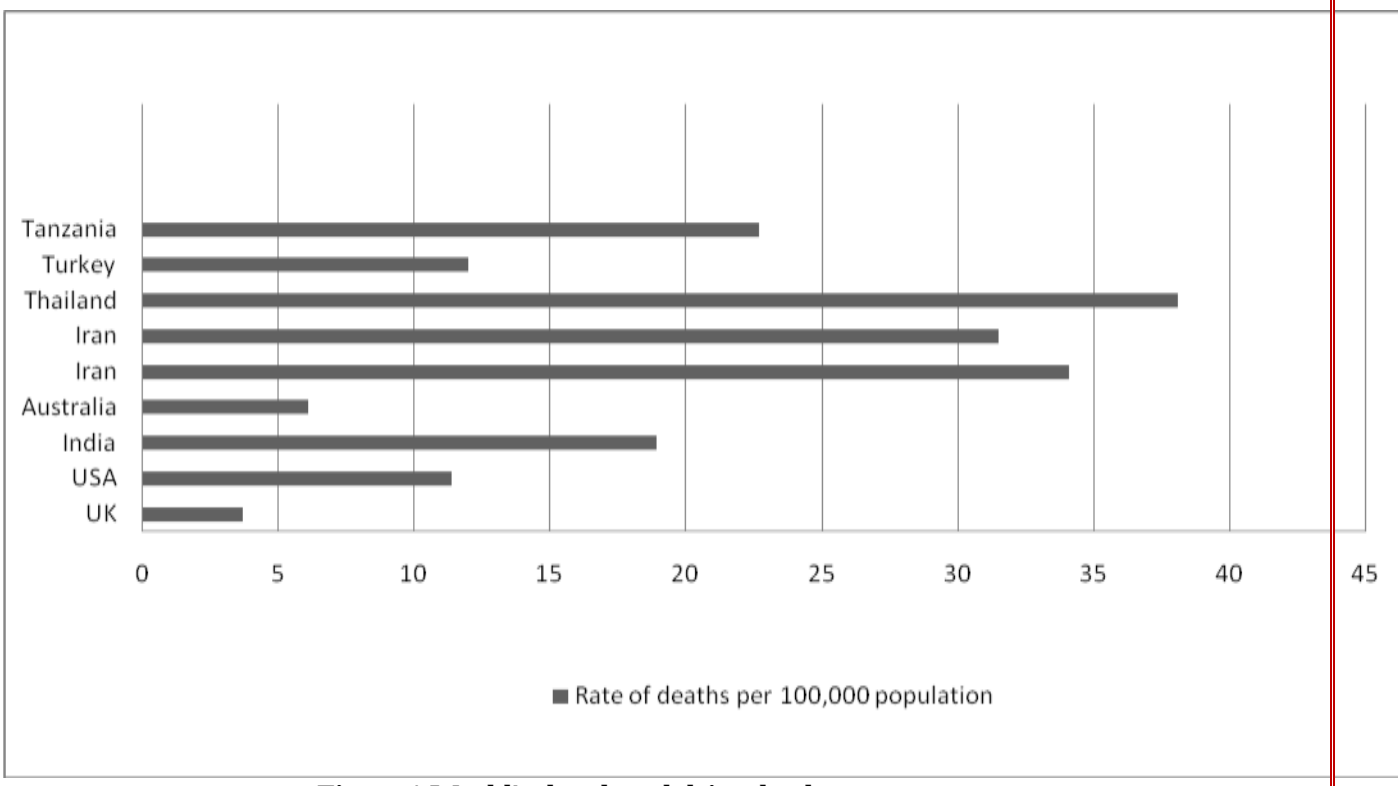


Figure 1 World's drunk and drive death rates

Chong Fang Fu et.al used Microcontroller Unit (MCU) as heart for the system. The system is divided into two parts; one part is for detecting, and another for controlling the parts installed in the car [7]. The working of the system is when the driver sits, in position pressure sensor gets activated and send alert to voice module to detect alcohol for the driver. Then the detection process starts and displays the amount of alcohol taken on Liquid Crystal Display (LCD). If the amount of alcohol detected is normal, voice promoted car can start. If detects more than the alcohol allowed makes the car cannot work if driver ignores the command and tries to start the car immediately breaks will activate and makes the wheels not to rotate [7].

Alternative methods that have been proposed relate to implanting devices in the automotive vehicle, which can autonomously detect the alcohol content in the breath of the driver, microcontroller based intelligent devices in the vehicle can then correlate the amount of alcohol in the breath to that in the blood and can trigger various alerts which can be relayed to the appropriate law enforcement authorities, so that they can take timely actions to prevent any dangerous situations which may arise due to the actions of the protagonist. In this project we propose a system consisting of GPS, GSM devices, alcohol sensors and a microcontroller running a set of programs which monitors and controls the system.

II PROPOSED SYSTEM

The proposed system can be viewed as three different phases, based on the functions carried out by the modules of the prototype. They are the processing phase, the data acquisition phase and the communication phase.

The block diagram of the proposed system comprising of ARM7 based LPC2148 microcontroller which carries out the functions of the prototype, PAS 32U alcohol sensor used for monitoring the presence of alcohol and the GPS and GSM modules for sending the location of the vehicle through a message. The block diagram of the proposed system is shown in the Fig. 2.

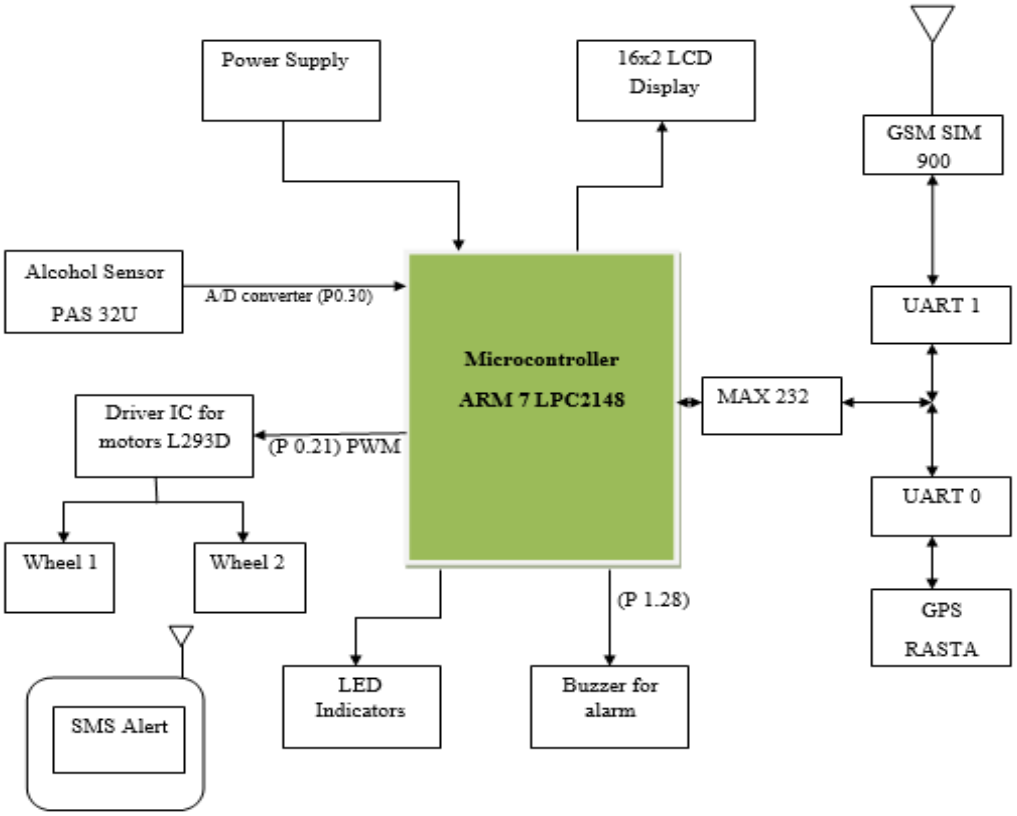


Figure 2 Block diagram of proposed system

2.1 Processing phase

The microcontroller acts as a processing unit and executes all the functions in the prototype. For executing the instructions microcontroller is programmed in 'C' language with the help of Kiel software. LPC2148 based on 16-bit/32-bit ARM7TDMI-S CPU with real time emulation and embedded trace support, that combine the microcontroller with embedded high speed flash memory ranging from 32kB to 512kB is used in the system. [8].

The microcontroller development board is activated with power supply of 5V by using power regulator. By activating the serial ports in the microcontroller, communication path is established by using UART1 and MAX 232. The analog to digital convertor pins is used to receive the data from the alcohol sensor in the analog form

and to convert the received data to digital form and transfer the data to microcontroller. By using the Pulse Width Modulation (PWM) pin the speed of the motor is controlled automatically by the microcontroller.

2.2 Data acquisition phase

In this prototype data acquisition is sensing of amount alcohol taken by the protagonist. This process is done with the help of alcohol sensor PAS 32 U. Due to the low voltage variations and instability of voltage; microcontroller is not able to drive the sensor directly so, by using LM358 op-amp driving circuit the connection path is established between microcontroller and sensor [9]. The sensor used in the project is shown in the Fig. 3.

According to the amount of alcohol sensed, variation in voltages is produced by the sensor. The alcohol sensed is inversely proportional to the voltage produced by the sensor. The data from the sensor used in this prototype is sent to the microcontroller by activating P0.30 pin of the microcontroller. Speed of the motor is proportional to the voltage generated by the sensor.

Figure 3 Alcohol sensor (PAS 32 U) used for sensing the content of alcohol

2.3 Communication Phase

In this prototype communication phase is used for sending SMS alert to law and enforcement authorities in the extreme situations along with the positioning values of the vehicle and uploads the riding conditions to the web server when any sign of the alcohol is detected. The communication phase consists of GSM SIM 900 module and GPS module.

Both the modules are connected to relay through UART1 of the microcontroller board. The relay is an electronic circuit which acts like switch to trip the connection between GPS and GSM module. The data sent from the communication path is in serial, to the UART1. The data is sent to the microcontroller through MAX232 from UART1. In this prototype for uploading the data to web server the GPRS phase of GSM modem is used. The GPS modem locates the position of the vehicle. The GSM modem responds to the microcontroller with the AT (Attention) commands [10].

The overall built proposed system consisting of LCD display, PAS 32 U sensor, LPC2148 microcontroller board, GPS and GSM modules is shown in the Fig. 4.

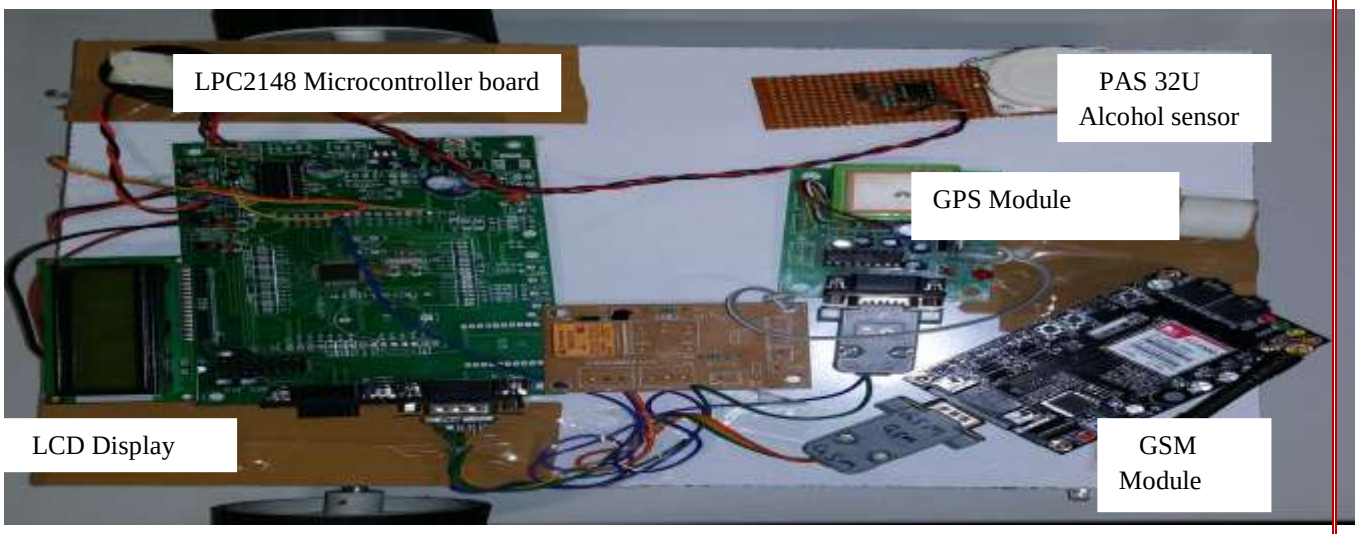


Figure 4 Snapshot of 'Smart drunken driver detection and speed monitoring system' with PAS 32U Alcohol sensor, GPS and GSM modules interfaced to the LPC2148 Microcontroller board.

2.4 Working of the proposed system

The working of the system starts with sensing of the content of alcohol detected by the sensor. When no content of alcohol is detected the prototype is made to run normally (100kmph). The speed varies according to the content of alcohol detected by the sensor. The flow chart of the proposed system is shown in the Fig 5.

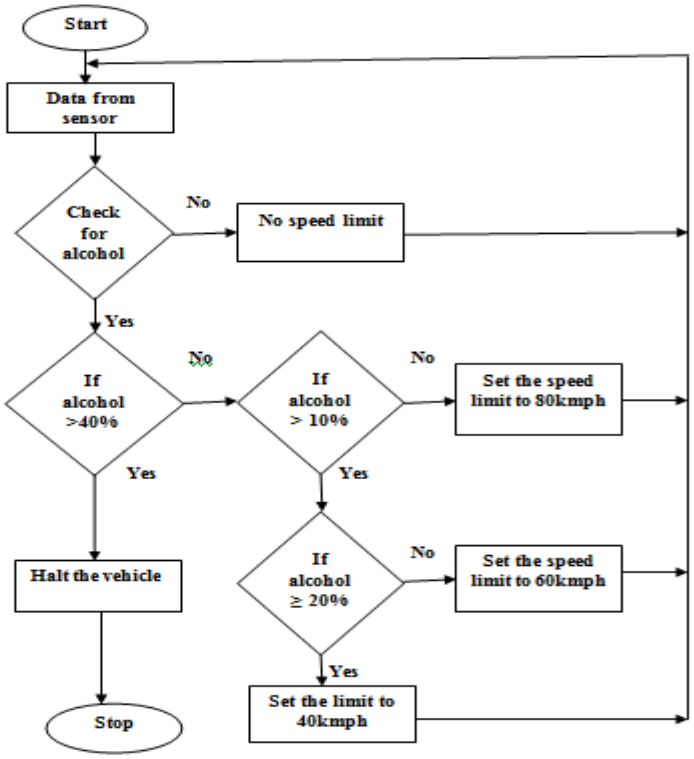


Figure 5 Flow chart of the prototype

The algorithm for microcontroller program is shown in the Fig 5. The program starts with initialization of all components, after receiving the activation (AT) command from GSM module and starts acquiring the data from the alcohol sensor. If no sign of alcohol detected in the breath of the protagonist, the program runs in the same loop. If system detects any sign of alcohol beyond the threshold, then the detection process is divided into three different sections. If 10% of alcohol detected from the driver then speed of the vehicle is cut down to 80 kmph automatically. For 20% to 30% of alcohol content the speed of the vehicle is made to maintain at 60 kmph. When the alcohol content of more than 30% detected in the breath of the driver, a caution message is displayed on the LCD screen. If the driver ignores and does not stops the vehicle in the stipulated time, system stops the vehicle automatically and sends a SMS alert to law and enforcement authority with GPS locations and One Time Password (OTP). Whenever a sign of alcohol detected from the driver in the back end system starts uploading the data to web server continuously in particular intervals of time. The vehicle can only be restarted by entering the correct password.

III RESULTS & DISCUSSION

Whenever a sign of alcohol detected by the system data regarding to the amount of alcohol detected, speed, longitude and latitude values are uploaded to website. The content of the alcohol consumed by the driver is indicated in the LCD present in the prototype. The picture of the LCD indicating the information is shown in the Fig 6(a) and 6(b). The information regarding the location of the drunken driver is sent to the authorities automatically by a message. The message received in the mobile is shown in the Fig 6(c).

Figure 6(a) LCD Display when no alcohol is detected by the sensor.

Figure 6(b) LCD Display when 10% of alcohol is detected by the sensor.

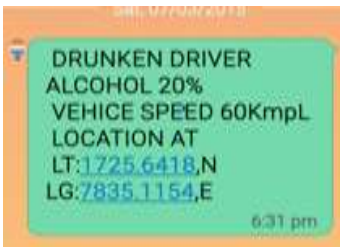
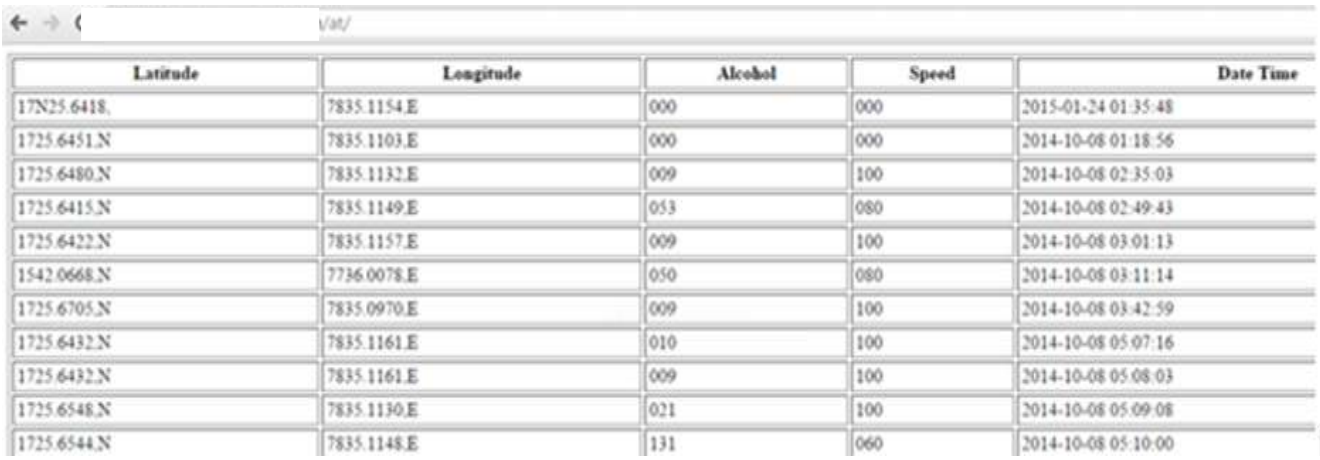


Figure 6(c) Message received by authorities with GPS location when 20% of alcohol detected.

The data is uploaded to the web server immediately the sign of alcohol detected in the breath of the driver. The data includes the latitude, longitude, amount of alcohol consumed, speed with which the vehicle is moving, date and time. The data uploaded is shown in the Fig. 7.



Latitude	Longitude	Alcohol	Speed	Date Time
17N25.6418,	7835.1154,E	000	000	2015-01-24 01:35:48
1725.6451,N	7835.1103,E	000	000	2014-10-08 01:18:56
1725.6480,N	7835.1132,E	009	100	2014-10-08 02:35:03
1725.6415,N	7835.1149,E	053	080	2014-10-08 02:49:43
1725.6422,N	7835.1157,E	009	100	2014-10-08 03:01:13
1542.0668,N	7736.0078,E	050	080	2014-10-08 03:11:14
1725.6705,N	7835.0970,E	009	100	2014-10-08 03:42:59
1725.6432,N	7835.1161,E	010	100	2014-10-08 05:07:16
1725.6432,N	7835.1161,E	009	100	2014-10-08 05:08:03
1725.6548,N	7835.1130,E	021	100	2014-10-08 05:09:08
1725.6544,N	7835.1148,E	131	060	2014-10-08 05:10:00

Figure 7 Snapshot of the data uploaded to the website

IV CONCLUSION

This paper has resulted designing, analysing and building a prototype of the smart drink and drunken driver detection and safety system for vehicles. The sensor used for detecting alcohol for breath of the human is PAS 32U. The smart alcohol detection and safety system for vehicles prototype has been built and test runs have been carried out for the analysis of the system and the evaluations for the prototype have been carried out with its sensor, controllers and the communication modules compared and evaluated.

REFERENCES

[1] Government of U.K. (2012). *RAS51001: Estimated number of reported drink drive accidents and casualties in Great Britain 1979-2012.* Retrieved 10 19, 2014, from www.gov.uk: https://www.gov.uk/government/statistical-data-sets/ras51-reported-drinking-and-driving

[2] US Department of Health & Human services. (2004, october 1st). *National Institute on Alcohol Abuse and Alcoholism Publications Distribution Center National Institute on Alcohol Abuse and Alcoholism Publications Distribution Center* . Retrieved october 12th, 2014, from http://pubs.niaaa.nih.gov/publications/aa63/aa63.html

[3] BHATNAGAR, G. V. (2011, November 22). *The Hindu News Paper.* Retrieved October 19, 2014, from http://www.thehindu.com/todays-paper/tp-national/tp-newdelhi/70-per-cent-of-road-accidents-in-india-due-to-drunken-driving/article2648900.ece

[4] U.S Department of transportation, National highway traffic safety Administration, FARS. (April, 2012). *Table of comaring alcohol related and non alcohol related highway accidents.* U.S Department of transportation.

[5] Worldhighways.(2014). *Road fatalities drink driving.* Retrieved from http://www.worldhighways.com/: http://www.worldhighways.com/sections/contraflow-interview/contraflow/road-fatalities-drink-driving/

[6] T. Karthick, S. A. (2010). *E-Eyanthra: Perspiration based drunken driving prevention system.* Chennai, India

[7] Chong Fang Fu, L. C. (2012). In - vehicle Alcohol Detection Based on MCU and Design and Implementation of Safety Control System . *Proc. of 2nd International Conference on Future Computers in Education Lecture Notes in Information Technology*, China.

[8] NXP B.V. (2011, AUGUST 12). *http://www.nxp.com.* Retrieved October 10, 2014, from http://www.nxp.com/documents/data_sheet/LPC2141_42_44_46_48.pdf

[9] PAS Systems International Alcohol Sensor Systems. (2014). *PAS Systems International Alcohol Sensor Systems*. Retrieved November 3, 2014, from https://pasintl.com/categories/fuel-cells

[10] SIM Technology Group. (2012). *SIM COM*. Retrieved November 08, 2014, from www.sim.com: http://wm.sim.com/producten.aspx?id=1019