ENEL370 Electronics 1 – 2012 Project
Breath Alcohol Indicator

Introduction

We are all very aware of the dangers associated with excessive alcohol consumption. However, it is often difficult to keep track of how much alcohol you may have consumed (especially with some of the exotic alcoholic concoctions you may be handed at various "functions"). In such situations, it would be very handy to get some sort of quantitative information on how much alcohol you have taken on-board. Personal breath alcohol sensors/indicators can be of aid to some degree in these situations.

Important Note: No breath alcohol sensor/indicator is 100% reliable. Whilst the information given by a personal breath alcohol indicator may help identify when you have consumed a significant amount of alcohol, various environmental factors can affect sensor accuracy and function, and as such the indicated output may be at a considerably lower level than actual breath alcohol. Relying on the indicator output to be accurate for regulating your drinking may result in potentially dangerous levels of alcohol consumption if the output is inaccurate and low. There is no substitute for drinking in moderation!

Breath Alcohol Indicator

You are to design, build, test, and report on, a simple (no microcontroller) breath alcohol indicator using analogue circuit systems. The indicator needs to be able to provide an output indication of low, moderate, and high breath alcohol. Specifications and requirements are listed below:

- Use Electronics Store components ONLY.
- Should work for expected breath alcohol concentrations.
- Must give stable indication within a normal exhaled breath time.
- Must be able to operate with a single voltage source that may vary between +7.0 V to +9.0 V. Over this voltage range, the output is to be unaffected (give the same output indication). For the project, a bench-top power supply is to be used.
- As low noise and high stability as possible.
- Project budget must be less than $25 (including the alcohol sensor at a budget cost of $5, and the amount of vero-board used).

Project Instructions

Group Setting

You will be working in groups of **2** people. Team up with someone in the class. EVERYONE in the class must submit the name of their group partner to the "Project Group Submissions" activity in the "Project" Section of the ENEL370 Learn resource. This **must** be done by **4pm Friday 24 February**. If you can not find a group partner, submit "No partner" in the Group Submissions activity, and you will be allocated to a Group. **Note: If you do not submit your name, you will NOT be allocated to ANY group and will lose meeting deadline marks.**

Indicator Design and Build

Your group must design the entire breath alcohol indicator using **only** components available in the electronics store. Apart from the other specifications and requirements stated above, this is the only restriction on the design.

The alcohol vapour sensor can be obtained directly from Paul Gaynor (datasheet on Learn). The rest of the components are to be obtained from the electronics store, and booked out on the ENEL370 Green card. Keep track of your components cost – this should be identified in your report. Enquiries about electronics store components and booking should be directed to Dudley Berry.

Your circuit is to be constructed on vero-board (available from the Electronics store). While a breadboard can be used for circuit prototyping and testing, no breadboarded circuits will be accepted for assessment.

Bonus Marks and Other Important Considerations

A **major** element of modern electronics design is circuit simulation. If your group can include significant and meaningful simulation results, you can earn up to an extra 10 marks (up to a maximum of 100/100 for the project). Make sure your simulations show that the design is operating according to the desired specifications.

In order to obtain the best stability and accuracy from your indicator, the design should attempt to minimise both amplifier-based and circuit-based noise.

Consideration should be given to the start-up time required for the sensor to become stable enough for operation. Can your group include some sort of simple start-up timer/indicator that lets the operator know when they can use the indicator for breath testing? If not, can you suggest ways that start-up protocols could be implemented?

Consideration should also be given to how to ensure the sensor is exposed to just the breath being tested (and not mixed with ambient normal air). The solution to this consideration should be included in your completed hardware.

How do you intend to calibrate your indicator? While it is beyond the scope of this project to calibrate to precisely known alcohol vapour concentrations, you should be able to generate a voltage versus vapour concentration curve somewhat like the example available on Learn. How do environmental conditions such as temperature and humidity affect the calibration, and can these be relatively easily compensated for (especially temperature)?

Consideration must be given to handling of static-sensitive components (the ICs). You should ensure you are working on an anti-static surface, and use an anti-static wrist strap.

Hardware Construction and Testing

Hardware construction (eg. soldering) and testing is timetabled as a lab. The Electronics Lab will be available at the indicated timetabled times. You can also work at other times in the student electronics workshop. Randy will also lend out some containers of diluted mouthwash to test sensor operation and help with calibration.

Report and Hardware Submission

The completed report must be converted to .pdf format and submitted to the "Project Report Submissions" activity in the "Project" Section of the ENEL370 Learn resource **before 5pm on Friday 25 May**. Name your file as ENEL370projectGroupXX.pdf, where XX is your group number (group numbers less than ten use 01, 02 – 09 format). **No late reports will be accepted.**

The report should be of a standard format, with Abstract, Introduction, Design Description, Simulation Results (if any), Test Results, Discussion & Conclusions, and References. As a guide, around 20 pages with figures should be sufficient. Be sure to take plenty of oscilloscope screen shots to show that your indicator is meeting specification.

Your hardware must be submitted to Dr Gaynor's office (A506) **before 4pm Friday 25 May** (available from 3pm-4pm).Your hardware will be independently tested for function as per detailed in this project information document (marked out of 35). Submit hardware with flying leads for power terminals (must be labeled). Special instructions on how to operate your hardware should be included with the hardware submission (eg start-up prototcol). If your hardware fails to meet specifications and requirements during testing, your group will be notified, and you will be allowed just 1 extra hour to work on the hardware to sort out any problems (time by specific arrangement via email correspondence). The hardware will then be re-tested and given a final mark.

Marking Schedule (out of 100)

Circuit Design & Function	
Hardware meeting specifications and requirements:	35
Circuit Simulation Results:	*10 (bonus)*
Circuit Construction (vero-board)	
General layout:	2.5
Construction quality:	2.5
Meeting Deadlines	
Project group notification:	1
Report submission:	1
Hardware submission (not given if resubmission required):	2
Report	
Abstract:	4
Introduction:	6
Design Description:	15
Test Results (incl. simulations if any):	15
Discussion & Conclusions:	8
References:	8