Arduino Brethalyzer

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***Abstract*— Our goal for this project is to recreate the same functionality and more as a standard issue breathalyzer. Using an Arduino microcontroller and assembly programming.**

***Keywords*— Arduino, Blood Alcohol Content, Breathalyzer, Drinking, College, Safety.**

I. Introduction

This project consists of working with hardware and software together to build a functional electronic breathalyzer for educational purposes

A. Background

Breath analyzers are used for estimating blood alcohol content in a person's blood. Using an electrochemical reaction which oxidizes alcohol in the sample and produces an electrical current. Which will be measured by the MQ3 Alcohol sensor, interfaced with the Arduino Microcontroller.

B. Problem

Underage drinking is a major issue in the United States. A study done in 2019 by the Youth Risk Behavior Survey found that in the past 30 days, 29% of kids underage had had alcohol. While 14% were documented as having binge drank(CITE THAT). Children who are just starting to become adventurous with alcohol have no way to clearly determine their own tolerance levels. Although there is no way to be able to physically stop the illegal underage consumption of alcohol, there are ways to help protect the youth of America from allowing a simple mistake to become a life threatening event. Breathalyzers are used by police to measure a person's blood alcohol content (BAC). A handheld breathalyzer could potentially be used to be a convenient and easy way for young adults to be able to have some indication of their own tolerance level. With the use of a handheld breathalyzer, the hope is to cut down on drunk driving and alcohol poisoning in young adults.

C. Literature Review

Alcohol can be found everywhere in America. Children see it in their homes, advertised on television, and while they are out eating. "Adolescent alcohol use is one of the most difficult behaviors to change because alcohol use is so ingrained in the U.S. culture" [2]. America has been tasked with trying to find solutions to the problem of illegal underage consumption of alcohol.

There are many reasons as to why children get into alcohol before they are of legal age. "According to the theory of triadic influence (TTI), which integrates many behavioral theories into a comprehensive "mega-theory" of health behavior, all behaviors have roots in three domains: the person's personal characteristics, current social situation, and cultural environment" [8] [2].

Schools have tried to take their approach to help teens and young adults differ from their desire to experiment with alcohol. This results in school assemblies to talk to the kids about the problems. Schools have even started to do extra events after school hours to try and entice the children to come and have monitored fun instead of drinking or being unsupervised. Extracurricular activities are offered and encouraged to students. "About 40 percent of adolescents' waking hours are discretionary—not committed to such activities as eating, school, homework, chores, or working for pay—and many young adolescents spend virtually all of this time without companionship or supervision by responsible adults" [1] [2]. Schools and communities have hoped that encouraging and offering safe and monitored activities for students,

that it would be part of the 40% of the student's time being discretionary. The schools have been trying to implement more things for students to do and be able to provide more resources to the students who are struggling.

Schools are not the only ones worried about the underage people consuming alcohol. Laws have been put in place that have tried to make it harder for alcohol to fall in the wrong hands. Many implementations have been issued by the government in order to try and combat the problem. This includes raising the minimum legal drinking age (MLDA), curtailing commercial access, limiting social access, and reducing economic availability [2]. There is now a policy that if someone sells alcohol to a minor, that there are legal actions taken against them. "When an illegal sale is made, penalties are applied to the license holder and/or the clerk or server who made the sale. Such compliance checks can significantly reduce sales to minors." [9][2].

Although all these measures have been implemented in society, the current crisis of underage drinking is still an issue today. The consequences of underage drinking can lead to drownings, car accidents, violence, crime, suicide, fetal alcohol syndrome, poisonings, psychoses, and alcohol dependency [8]. Underage drinking accounts for 20% of car accidents, 7% of nonfatal and 30% of fatal burns and drownings, and 9.1% of suicides in America. Alcohol involved in crimes was indicated to be around 41.3% for homicides, 43.4% of sexual assaults, 37.3% of other assaults, and 24.4% of robberies and property crimes of all crimes involving people under the age of 21 according to 1997 survey of inmates in State and Federal Correctional Facilities (Bureau of Justice Statistics and Federal Bureau of Prisons, 2001) and the 1987 Survey of Youths in Custody (the only national survey of this population; Bureau of Justice Statis- tics, 1994) [8]

Despite the increase in awareness in society about the problem of underage drinking, the problem still persists in America. The introduction to the device known as a breathalyzer was developed in 1954. The modern-day breathalyzer is a portable device that is roughly 9x10x8 inches. The instrument can be compatible with either a 6- or 12-volt storage battery or on a 50/60 cycle alternating current [2]. The idea of the breathalyzer is to determine someone's blood alcohol content.

Blood alcohol count is based on the "2100:1 partition ratio". The ratio explains that the average temperature of expired alveolar air has 2100 mL of air that contains the same amount of weight of ethanol as 1mL of blood when exposed to 34-degree Celsius weather. Yet, for every milliliter of blood, it contains 2100 times the weight of ethanol as a milliliter of alveolar air. This ratio is relevant because this reflects the equal distribution of ethanol that is found between alveolar air and blood. Breathalyzers held a 52.5 mL capacity for the breath that is trapped. The equation found in figure 1 shows how the measurements taken are inserted into the formula to give us the correct reading of BAC percentage. [2]

The Arduino Uno will be used to create a breathalyzer that people who are new to drinking can utilize. This microcontroller can be powered with either a USB or external power supply such as a battery. It uses 5V input voltage and has 16 MHz clock speed [7]. We will be using the MQ3 Alcohol Sensor to interact with the Arduino. This is the part that will actually read a person's alcohol concentration. The sensor works by detecting levels of ethanol in the air. The main issue seems to be calibrating the sensor to get it to read correctly. This is done by calculating what values correspond to what alcohol percentages and making sure the reading is correct. You can test it using mouthwash or isopropyl alcohol [4].

II. Project Objectives and Outcomes

A. Objectives

The objectives of this project are: To produce a device that a person can blow into and determine their level of drunkenness, To help a person determine when it is unsafe to continue drinking, and To help keep track of the amount of drinks that a person has consumed. While the device will not measure a person's exact BAC, it will be able to give them an indication of how much they have had

to help determine when they should stop by an indicator of red, yellow, and green to demonstrate the level of caution that should be taken. To aid in helping a person determine whether it is safe to continue drinking, there will also be a feature for counting the number of drinks that a person has had. For every drink a person consumes, he/she can click a button, and the device will keep track of the number of clicks it has received. We will create this device by December 6th, 2021.

B. Outcomes

This device will help people who are new to drinking. It will allow them to be more aware of how much they have consumed by tracking their number of drinks and displaying their level on the scale. Consequently, the number of drunk driving, alcohol poisoning, and binge drinking deaths in people in the United States aged 18-25.

III. Project Methodology

In order to complete this project, we are going to need a minimum of 6 different hardware components. We need the Arduino Uno microcontroller to interface the input and output from the sensors and LEDs. We will use assembly programming to communicate with the MQ3 Alcohol sensor. Along with some C/C++ functions to handle the remainder of the program's functionality. Everything will be prototyped on a breadboard. For the alcohol sensor, that will be connected to the Arduino pin A0 for the analog signal. Then the output LEDs are connected to the breadboard and Arduino. From there we just have to get the software working so that we can begin testing and calibrating our prototype.

IV. Project Management

Project Leader: Alec Lienhard.
The project lead role will consist of communicating with team members, always keeping the larger goal in mind. The Project Leader will foster a positive work environment and make sure that team remains on track.

Scrum Master: Heather Fetty
The Scrum Master will be responsible for facilitating a productive work environment, probing for progress, emphasizing teamwork and encouraging timely completion of tasks.

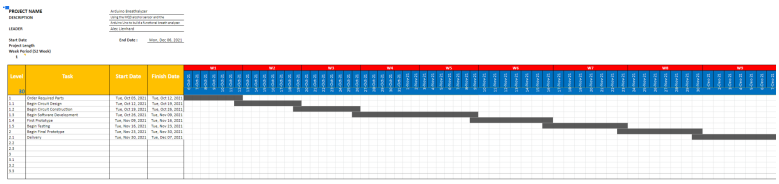
Planning Manager: Delaney Irwin
The Planning Manager will work with each member to coordinate meeting times, goals for what will be completed at each meeting, and ensure that the team adheres to the plan.

V. Implementation Plan

A. Work Schedule

Work Schedule		Dates								
		4-Oct	18-Oct	1-Nov	8-Nov	10-Nov	19-Nov	1-Dec	4-Dec	
Tasks to complete	Heather Fetty	Proposal: Literature review, Implementation plan, Objectives, Outcomes	Work on simple code for sensor to make sure it works	Help code LEDs based on alcohol concentration value read	Work on prototype	Finish Prototype - hopefully have at least something working	Testing to ensure sensor is reading correctly; make more	Final Prototype - solder, add clicker for drink counter	Final Report, finishing touches	Final Rep
	Delaney Irwin	Proposal: Problem, Literature review, background, Implementation plan	Work on simple code for sensor to make sure it works	Code LEDS based on alcohol concentration read	Work on prototype	Finish Prototype - hopefully have at least something working	Testing to ensure sensor is reading correctly; make more accurate	Final Prototype - solder, add clicker for drink counter	Final Report - finishing touches	Final Rep
	Alec Lienhard	Proposal: Abstract, Methodology, Project management, Gantt chart, budget	Order Arduino, Alcohol Sensor, and Ohm Resistor	Test Sensor code; callibrate sensor	Work on prototype	Finish Prototype - hopefully have at least something working	Testing to ensure sensor is reading correctly; make more accurate	Final Prototype - solder, add clicker for drink counter	Final Report - finishing touches	Final Rep

B. GANTT Chart



VI. Budget

Parts List

Qty	Breath Analyzer Components		
	Name	**Price***	**Purpose**
1	Arduino Uno	$22.95	Microcontroller, Interface for our hardware components
1	MQ-3 Alcohol Sensor	$4.95	Sensor for reading current from alcohol reaction
9	330 Ohm Resistor	$2.25	Limiting the current to each LED
5	Green LED's	$0.35	Light up; indicate "not drunk"
3	Yellow LED's	$0.35	Light up; indicate "caution"
2	Red LED's	$0.35	Light up; indicate "do not drive"

*Includes shipping and taxes

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