Drowsy Driving

Manitreddy Mallesh
Heritage High School

Venuja Hettiarachchi
Lebanon Trail High School

2022-2023

Engineering Design & Development
FISD Career and Technical Education Center

Table of Contents

Project Write-Up

Prevention To Drowsy Driving

By: Manit Mallesh & Venuja Hettiarachchi

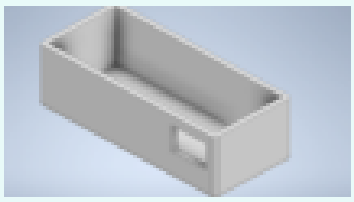
Problem Statement

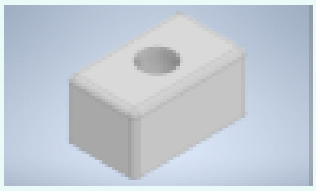
Drowsy Driving is a prevalent problem among truck drivers as they are on the road for hours on end. According to the National Highway Transportation Safety Administration, there are about 100,000 accidents that are caused by drivers who doze off at the wheel. Furthermore, 37 percent of adults have experienced falling asleep near crossways and high traffic.

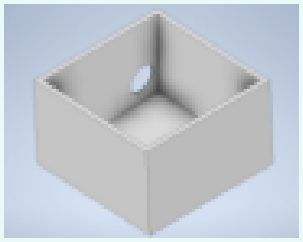
Our Solution

To solve the issue of drowsy driving, we wrote a code that'll use a webcam to detect and track the driver's eyes. Once the webcam detects the driver's eyes to be closed for longer than 1.5 seconds, then it'll sound an alarm to awake the driver.

3-D Model







Statisitics

According to Daniel Holoman and Associates LLP, truck drivers average less than 5 hours of sleep per night, while the CDC recommends about 7 to 8 hours. Moreover, about 64% of truck drivers reported that they regularly experience fatigue and 18% reported that they've fallen asleep behind the wheel.

Project Write-Up

Prevention To Drowsy Driving

Project Components, Parameters, and Photos

Project Components:

Stand:

The stand holds the webcam in place and connects to either the dashboard or windshield of the vehicle. It consists of 3D printed pieces which include the base plate of the stand and the container to hold the camera.

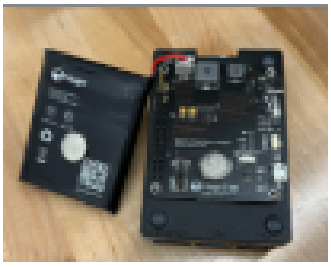
Code:

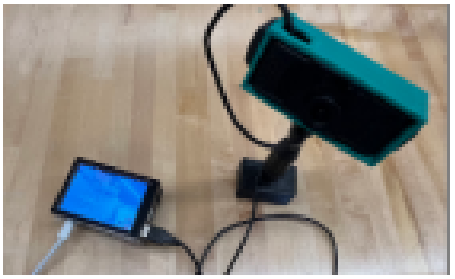
The code is written in Python and uses OpenCV, which is a machine learning software that holds the necessity features that are used to track the driver's eyes.

Project Parameters

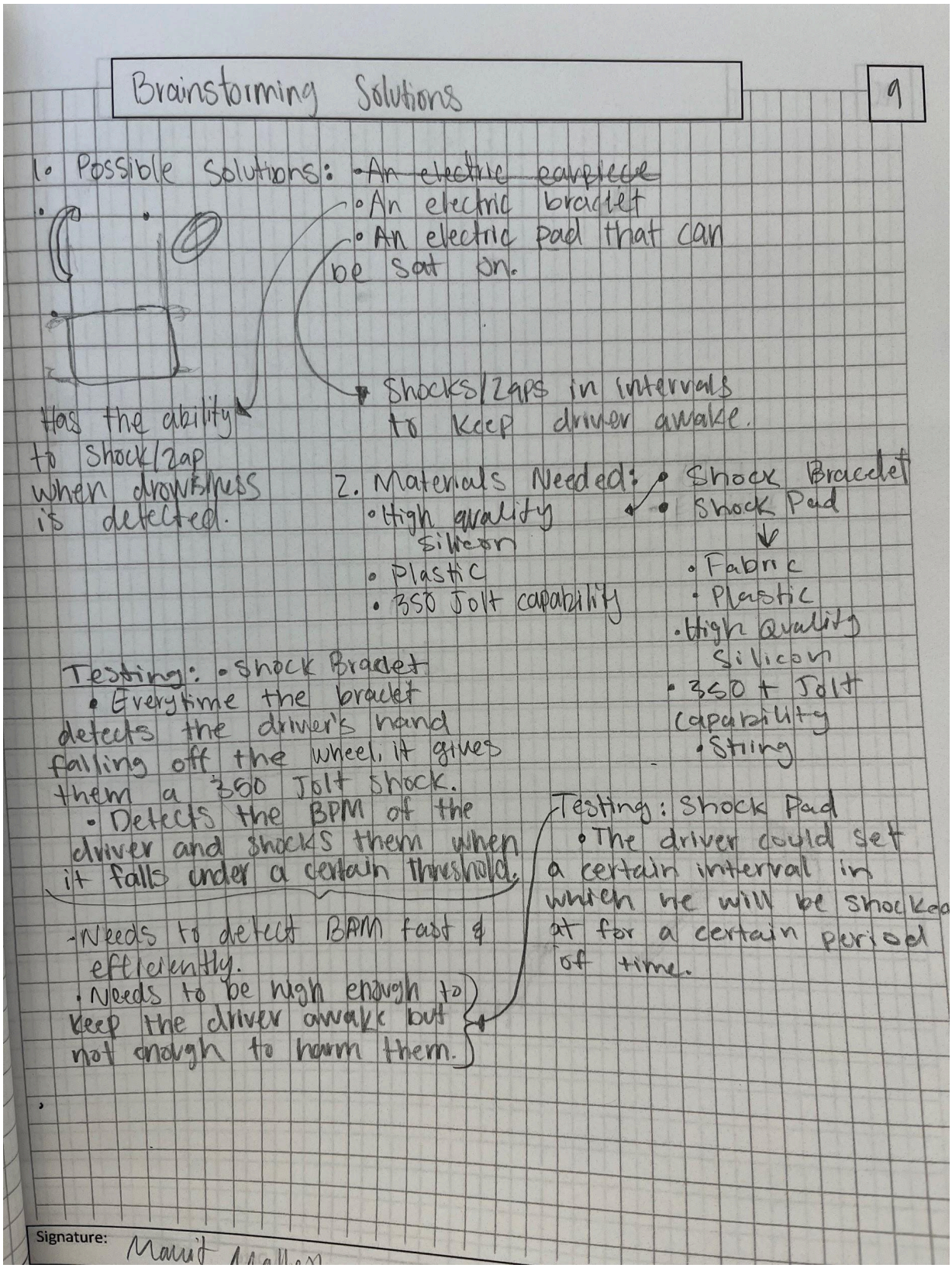
- Capable of long-duration use without charge
- The webcam can d detect yes during the night if the flashlight is turned on.
- The loud alarm can alert the driver when sleepiness is detected.
- Functionality is accurate even with constant head movement.

Photos of Our Prototype





Initial Brainstorming



Brainstorming Solutions 9

1. Possible Solutions: ~~An electric earpiece~~
   - An electric bracelet
   - An electric pad that can be sat on.

Has the ability to shock/zap when drowsiness is detected.

Shocks/zaps in intervals to keep driver awake.

2. Materials Needed:
   - High quality silicon
   - Plastic
   - 350 Jolt capability

Shock Bracelet
Shock Pad
- Fabric
- Plastic
- High Quality Silicon
- 350 + Jolt capability
- String

Testing: Shock Bracelet
- Everytime the bracelet detects the driver's hand falling off the wheel, it gives them a 350 Jolt shock.
- Detects the BPM of the driver and shocks them when it falls under a certain threshold.

- Needs to detect BPM fast & efficiently.
- Needs to be high enough to keep the driver awake but not enough to harm them.

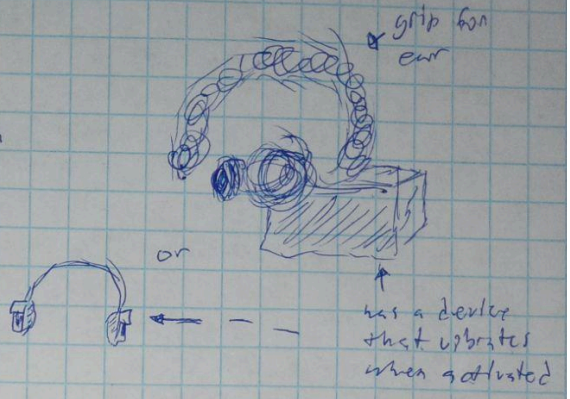
Testing: Shock Pad
- The driver could set a certain interval in which he will be shocked at for a certain period of time.

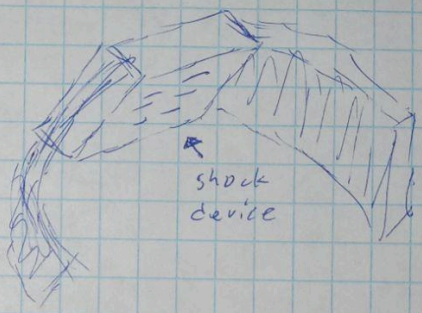
Signature: Manit Mallen

Initial Brainstorming

Possible Solutions
- Vibrating headset ✓
- shock bracelet ✓
- arm-covered shock strap
- earbud device with high pitch sound effects

Possible Materials
- batteries
- plastic
- rubber
- glue
- heart rate sensor
- skin conductance sensor
- low voltage shock device or tazor
- motor of device that vibrates
- wires
- other types of sensors





Testing
- A possible situation to test this would be exhausting ourselves one day where we had little to some sleep. Then use device an see if it work when we position ourselves in a car or a similar scenario
- To create this device we could research similar products online that have instruction on how to make certain parts. Also look up videos on parts to create which are used on what we're creating.
- Safety concerns would be whether the device would malfunction and damage/hurt the user. Ex: the shock device burns the user's flesh
- There aren't currently known ethical concerns

Project Expert

Company: University of Texas at Arlington

Person: Dr. Ishfaq Ahmad

Location: Arlington, TX

Website: https://www.uta.edu/academics/faculty/profile?username=iahmad

Correspondence:

Manitreddy Mallesh <manitreddy.mallesh.179@k12.friscoisd.org> Nov 10, 2022, 9:08 PM

to iahmad@cse.uta.edu

Hello Dr. Ishfaq Ahmad,

My name is Manit Mallesh, a high school senior student at Heritage High School in Frisco, TX. I am currently enrolled in Engineering Design and Development at the Career and Technical Education Center in Frisco, TX. This is an engineering research course in which students work in teams to design and develop an original solution to a valid open-ended technical problem by applying the engineering design process.

My partner and I are working to tackle the issue of drowsy driving. We plan to design and develop a bracelet or an earpiece that'll measure either bpm or the tilt of your head to alert the driver through an alarm and a buzz.

For this project, we will need professional expertise and guidance from someone experienced in Computer Engineering. Through your profile on UT Arlington's website, I found that you have education in both Computer Engineering and Electrical Engineering and have conferred extraordinary achievements in both. Moreover, you founded a program called Research Experience for Undergraduates, which is designed to investigate problems related to information extraction, model learning, and decision-making in sensor-rich environments for the safety and security of the environment. Your knowledge of various engineering fields and your passion for students to research real-life problems coincide with our project goals.

We would greatly appreciate your help during our project; please let us know if you would be willing to do so and in what case I can give you more information. If not, let me know if you think any of your colleagues might be able to provide additional information and resources.

Thank you for your time,
Manit Mallesh

Attack Path

Problem Statement:

Drowsy driving has become a common danger to many working adults causing a considerable portion of today's car accidents. More than 12 million people in the U.S. suffer from obstructive sleep apnea. Moreover, 37 percent of adults have experienced falling asleep near crossways and high traffic while driving, leading to many close cases of injury.

Health and Safety Justification:

Drowsy driving has caused at least 100,000 auto crashes each year, hurting an average of 40,000 people and resulting in over 1,500 deaths. Moreover, U.S. National High Traffic Safety Administration statistics showed that about 55% of drivers drove while drowsy in 2021. Fatigue from drowsy driving decreases vigilance and increases the risks of being unaware of your surroundings, resulting in an accident. These statistics show how people may be unaware or are reckless in their actions, harming themselves and the many others driving.

https://link.gale.com/apps/doc/Hours of sleep and fatigue in motor carriage
https://www.uclahealth.org/drowsy-driving
https://www.atsjournals.org/doi/full/10.1164/ajrccm.162.4.9907019

Economics Justification:

Drowsy driving has become more prevalent among working adults over the past few years. It has been observed that sleepiness causes 16% of all road MVAs and more than 20% of motorway crashes in the United States. This issue has led to an economic burden, such as the costs of accidents. Based on the 20 to 50 million people injured or disabled, the cost of disability for insurance is estimated to be around $2580 to $6450 billion annually. In 2013, there were about 32,000 crash deaths in the U.S., estimated at about $380 million in medical costs. Furthermore, a 2014 National Health Transportation Safety Administration study in the U.S. showed that motor vehicle crashes had an $871 billion economic and societal impact on U.S. citizens.

https://bit.ly/3FaI80I
https://link.gale.com/apps/doc/Hours of sleep and fatigue in motor carriage

Legal Justification:

Federal HOS regulations were laws regarding how long a driver may legally drive and how long they may be off duty. These laws were made to help regulate driver fatigue and working conditions. However, drivers have consistently violated HOS regulations, and the statistics brought from it show a negative correlation between HOS violations and sleep. This, on the other hand, implies a positive relationship between HOS violations and fatigue.
https://link.gale.com/apps/doc/A137864334/SUIC?u=j043905011&sid=bookmark-SUIC&xid=9b5e3109

Justification Articles

Source:

Car crashes rank among the leading causes of death in the United States. (n.d.). Retrieved October 18, 2022, from https://aaafoundation.org/wp-content/uploads/2018/02/2010DrowsyDrivingReport.pdf

Summary:

A study was done in the United States from 1999 through 2008, which involved 47,579 crashes that were a result of drowsy driving. Of the 3.9% of the crashes, about 7.7% were nonfatal, and 3.6% were fatal crashes involving drowsy driving. The imputed data, however, shows that there had been an increase of over 350% in drowsy driving. It estimated that about 7% of all crashes, 13.1% were non-fatal, and 16.5% were fatal, involving drowsy driving.

Critique:

The article does an excellent job of showing factual evidence of the increased rate of drowsy driving. The article states specific statistics that have led to fatal and non-fatal accidents from 1999 to 2008 and draws a reasonable conclusion. However, a lack of information in the article was apparent as the article needed to have a reason behind the drowsy driving. Identifying the potential root causes of drowsy driving can help bring light to the problem and raise awareness.

Website:

https://aaafoundation.org/wp-content/uploads/2018/02/2010DrowsyDrivingReport.pdf

Highlighted PDF:

Justification Articles

Source:

Vanlaar, W., Simpson, H., & Robertson, R. (2008). *Fatigued and drowsy driving: A survey of attitudes, opinions, and behaviors*. Internet Archive. Retrieved October 22, 2022, from https://www.sciencedirect.com/science/article/abs/pii/S0022437508000492

Summary:

This study gathered 750 Ontario drivers and gave them questionnaires about their driving habits. The results showed that most drivers (58.6%) have occasionally driven while fatigued or drowsy. Furthermore, of the 58.6%, 14.5% of the drivers admitted that they had fallen asleep or "nodded off" at least once. Consequently, about 2% of the respondents were involved in an accident due to fatigue or drowsy driving. These results have an undeniable correlation between drowsiness and the chance of getting into an accident or falling asleep at the wheel.

Critique:

The research did an excellent job of gathering drivers in Ontario for a data study. Moreover, the study made a reasonable conclusion from the data they gathered. However, they could've dived deeper into the causes of the fatigue or drowsiness while driving. Furthermore, they could have observed the time of the day they felt drowsy or fatigued when driving and the length of the car ride. This could have strengthened the conclusion of the result and maybe even the correlation between the two.

Website:

https://www.sciencedirect.com/science/article/abs/pii/S0022437508000492

Highlighted PDF:

Justification Articles

Source:

Moessinger, M., Sturmer, R., & Muhlensiep, M. (2021). Auditive beta stimulation as a countermeasure against driver fatigue. PLoS ONE, 16(1), e0245251. https://link.gale.com/apps/doc/A648073877/OVIC?u=j043905011&sid=bookmark-OVIC&xid=30b99b5a..

Summary:

Driver Fatigue is a serious problem throughout the world. Long trips, sleep deprivation, and a monotonous environment while driving can result in decreased vigilance or segments of sleep. This is one of the most common major influencing factors for traffic accidents. Also, driving fatigue has been extensively studied for many years, which eventually resulted in a method that measures how to quantify sleepiness with the help of electroencephalograms. This can help represent the wave patterns in the brain, which has advanced automated detection systems for tiredness in the automotive industry.

Critique:

The article helps demonstrate how driving fatigue is formed and statistics on how the brain reacts to sleep deprivation or fatigue. Also, the article has shown how scientists have previously used data on how driver fatigue affected accidents to help give statistics to find ways to improve traffic safety. However, the study's results and data are more subjective and based on physiological and performance levels, showing that their results are only theoretically valid.

Website:

link.gale.com/driverfatigue

Highlighted PDF:

Justification Articles

Source:

Monaco, K., Olsson, L., & Hentges, J. (2005). Hours of sleep and fatigue motor carriage. Contemporary Economic Policy, 23(4), 615+. https://link.gale.com/apps/doc/A137864334/SUIC?u=j043905011&sid=bookmark-SUIC&xid=9b5e3109

Summary:

A study of US drivers provided data supporting that two-thirds of drivers were reported driving while drowsy within the previous month and had fallen asleep at the wheel at a certain point last year. Drowsiness, sleeping at the wheel, and inattentiveness are two factors that have impacted car accidents more significantly than those attributed to alcohol or drug consumption on the part of truck drivers. Whether physiological or psychological factors cause driver fatigue, it is generally acknowledged that it plays a role in crashes.

Critique:

The authors examine hours of sleep and fatigue among drivers. To do this, the authors use data on the number of times a driver has dozed off or fallen asleep while driving. 35% of drivers reported dozing at the wheel in the month prior to an interview provided. Also, most other statistics show that driving more miles increases the chances related to falling asleep at the wheel. At the same time, increased hours of sleep decrease the probability of dozing. There is also evidence that drivers most likely to doze or sleep are penalized for late pick-ups and deliveries. Although these findings reassure that work policies have to an extent, helped safety concerns raised by fatigue, drowsy driving is still a significant problem that is constantly affecting drivers throughout the world.

Website:

https://link.gale.com/apps/doc/A137864334/SUIC?u=j043905011&sid=bookmark-SUIC&xid=9b5e3

Highlighted PDF:

Justification Articles

Source:

Drowsy driving. UCLA Health System. (n.d.). Retrieved October 17, 2022, from https://www.uclahealth.org/medical-services/sleep-disorders/patient-resources/patient-education/drowsy-driving

Summary:

The article explains how drowsy driving is a risk to anyone who gets behind the wheel of a car. As well as how losing sleep impairs your ability to drive, like drinking alcohol. Also, drowsy driving in relation to traffic safety, studied by the U. S. National Highway Traffic Safety Administration, has explained how the number of their accidents is underestimated as it has become a prevalent danger. Also, there is a problem with how many state policies don't have a code of conduct for reporting crashes relating to drivers falling asleep due to their numbers being too low. The article also explains how all drivers should learn more about drowsy driving, the need for sleep, and how to identify signs of drowsy driving in order to keep from making mistakes on the road. Some typical solutions for drowsy driving were to get a good night's sleep beforehand, pull off the road and get some sleep, or to avoid medication and alcohol, which can cause drowsiness.

Critique:

This article is relevant to our project due to how it explains how drowsy driving is a problem that is ongoing in the present world, which is the purpose for why our group is trying to create another solution for it. What is missing from this article may be more devices that could be potential solutions other than solutions brought due to changes in the environment or a change in one's daily actions. Also, the article does well by explaining many concepts with respect to drowsy driving to bring to the public the importance of preventing other cases of it. Also, something the article could improve on is having more statistics, although most of the article is explained thoughtfully.

Website:

https://bit.ly/3D28joO

Highlighted PDF:

Patent Research

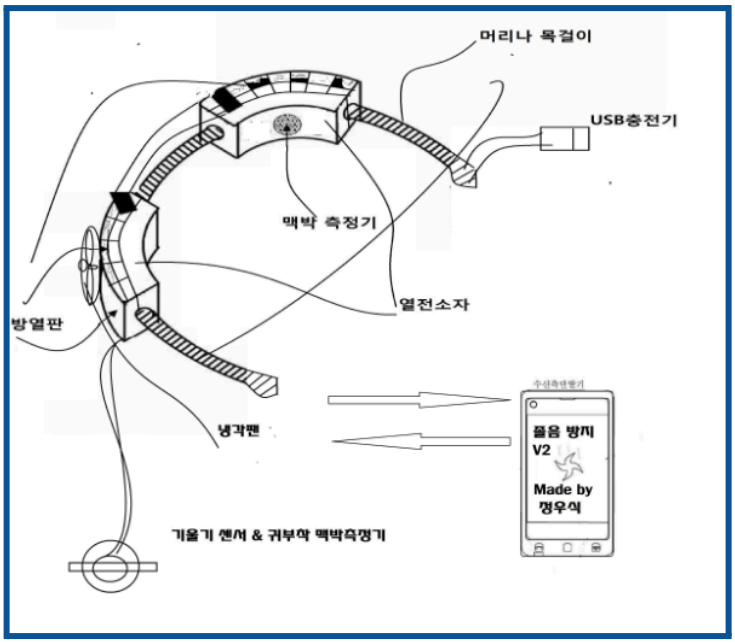
Product Name: Drowsiness Protector With A Heartbeat Analyser and Peltier Cooler

Patent Number: KR20150145666A

Patent Summary:
A pulse sensor could detect blood flow or the pulse rate and use a thermal electric module when drowsiness is detected. A Peltier element is used for the sensor and other products like refrigerators or wine coolers. It's used to rapidly cool an object to a temperature of ten degrees Celsius below zero or lower while occupying a small volume. This could be used within the pulse sensor by having a cooling function that can be added to stop drowsiness by adding a tit sensor when the user's head tilts at a prescribed angle or higher because of sleepiness.

Patent Critique:
The patents worn around the driver's wrist are only some optimal ways to prevent drowsiness. Thermal electricity or the cooling function is an excellent method to prevent drowsiness but does not guarantee prevention. Moreover, the drivers may forget to put on the bracelet every day, so having a device that doesnt put as much responsibility on the driver's memory could be beneficial to the cause of the device.

Images:



Patent Research

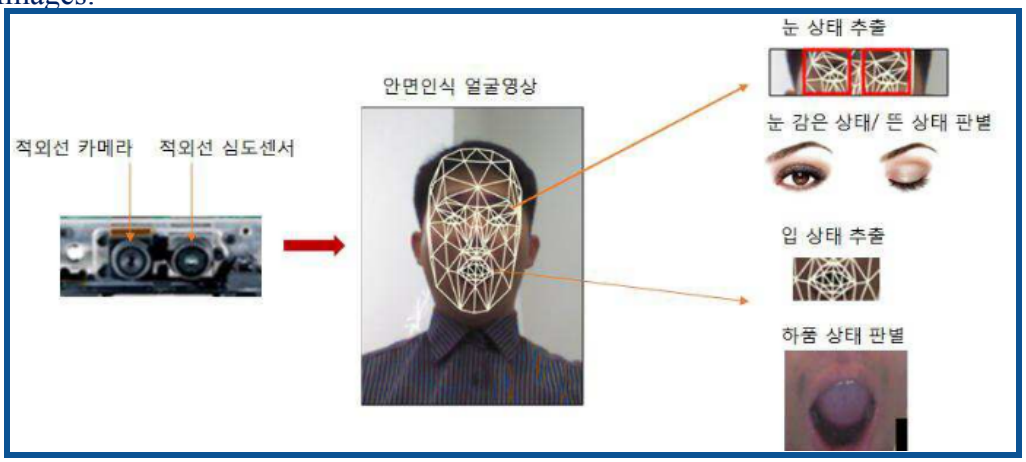
Product Name: 2-level drowsy driving prevention apparatus through motion, face, eye, and mouth recognition

Patent Number: KR101386823B1

Patent Summary:
A drowsiness detection system receives images and 3-dimensional depth information from a driving decision unit that captures the GPS that measures the driver's vehicle-driven state and an infrared depth sensor that observes the driver's face. The infrared depth sensor captures the driver's behaviors throughout the drive, like the intervals between yawns, the speed and frequency of head nodding, and the speed and frequency of eye blinking to develop a "precaution" when the driver starts to show signs of drowsiness. Once the "precaution" status is alerted, the driver will hear an alarm that sends a warning sound to the driver.

Patent Critique:
This patent uses complex and precise methods to detect drowsiness with its use of GPS measures the driver's vehicle-driven state and infrared that captures the driver's face. The downside of this patent is that although it might be efficient, this system would be costly. Compared to the current products in the market are around $100 and offer a bracelet that detects drowsiness through its few sensors, this patent would be significantly costlier, turning away customers' interest in the product.

Images:



Patent Research

Product Name:

Drowsy driving alarm system

Patent Number:

US7301465B2

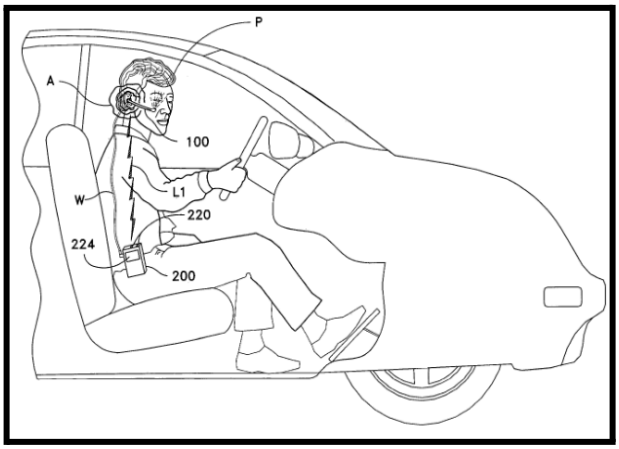
Patent Summary:

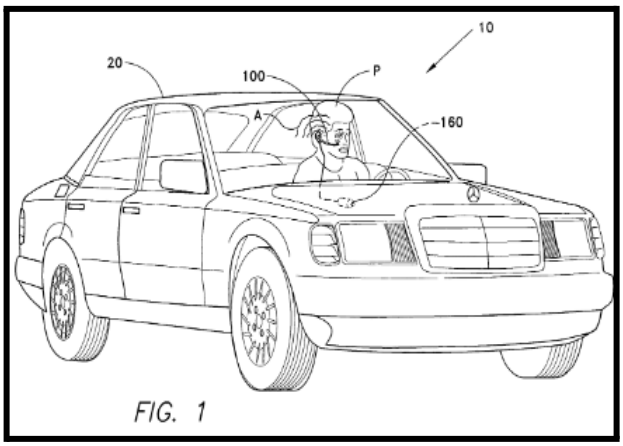
This patent is for creating an alarm system to prevent a drowsy driver from falling asleep while driving. It includes a monitoring system with a camera to detect changes in the driver's pupil. It contains circuits configured to detect certain aspects of the eye to determine whether the subject or driver is drowsy. This then alternates to an alarm system which activates to keep the driver awake. The alarm system includes a compass, sensors, an audible indicator, a visual indicator, and a physical indicator. The benefits provided by this system ensure to help prevent accidents due to the drowsiness of a driver.

Patent Critique:

This patent tries to solve drowsy driving by using an alarm system that makes noise to keep the driver awake. A good attribute of this product is how it contains a system to help detect drowsiness and know when to react, unlike similar solutions. Also, it contributes to preventing accidents due to drowsiness. Some bad attributes of this product would be how its visual system is prone to error, for mistaking the changes of the pupil due to exhaustion after work compared to drowsiness. This could cause problems for the alarm system to activate on the wrong stimulation. However, this patent helps our research by showing different ways of detecting drowsiness.

Images:





Patent Research

Product Name:

Drowsy-driving prevention method and drowsy-driving prevention system

Patent Number:

US11331025B2

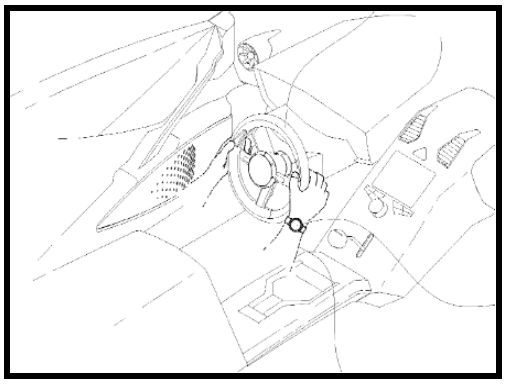
Patent Summary:

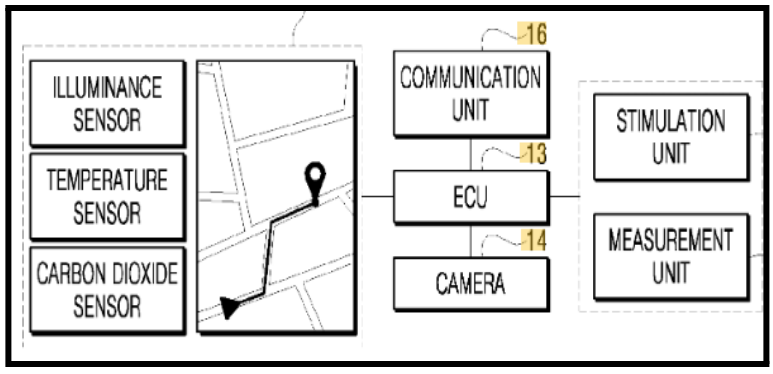
This patent is for a drowsy driving prevention system that includes AI algorithms using a 5G network connected to the network, which is used to control a stimulation that can detect the condition of the driver. A monitoring system is also included to detect the state of the driver: a GSR sensor, an electrocardiogram sensor, and a biometric impedance sensor. Most of the simulations in this system are based on the measurement of a biometric signal which then creates a stimulus to affect a sensory organ of the driver to keep them awake.

Patent Critique:

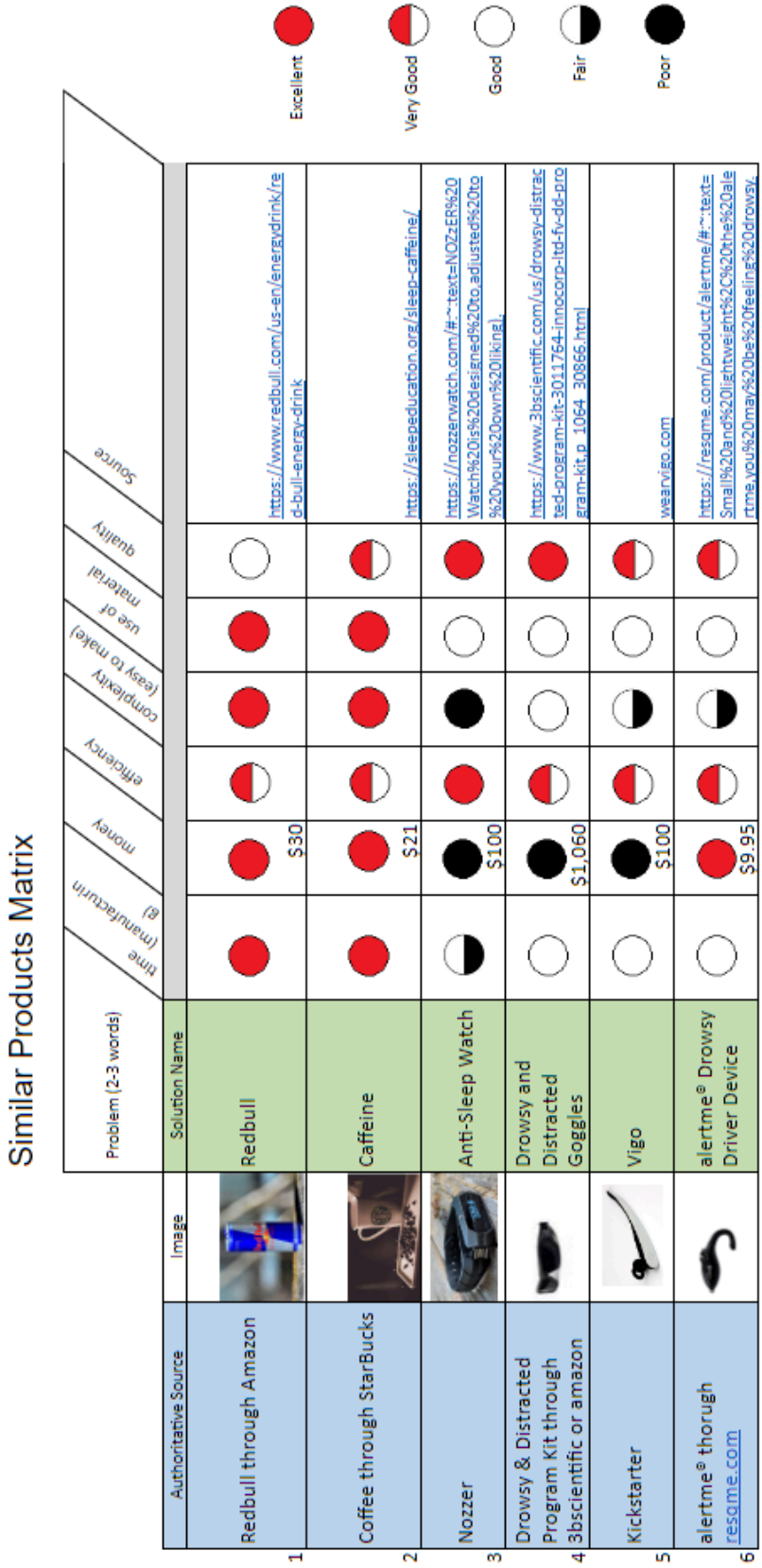
This patent attempts to solve the problem of drowsy driving by using a device that creates a change in current on the driver's skin or a vibration device to keep the driver awake from their previous drowsiness. A good attribute of this product is that its artificial intelligence can learn through the simulations made to make later data calculations more accurate. Some bad attribute of this product is that it is difficult to accurately figure out the difference between the aroused state and the drowsy state of the driver through the product's methods of analyzing the change of patterns for the body temperature, the heart rate, and the GSR.

Images:





Similar Products Matrix



Data Collection: Drowsy Driving

Conducting Market Research

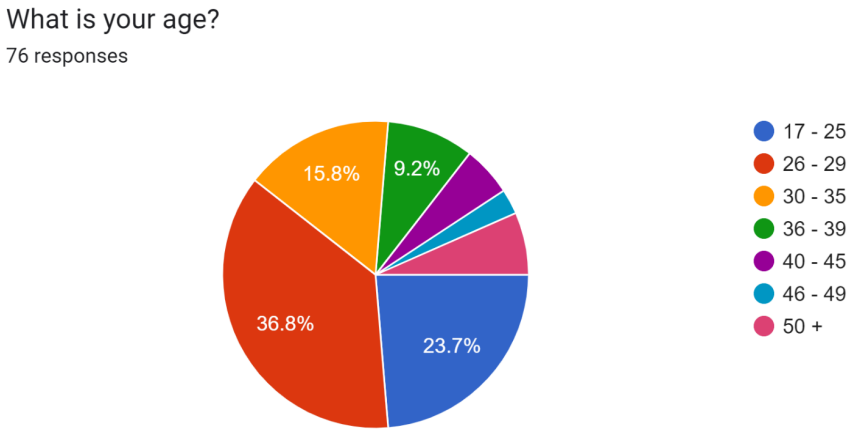
This survey targeted working adults, but our target consumer was later changed to truck drivers.

Problem Statement:

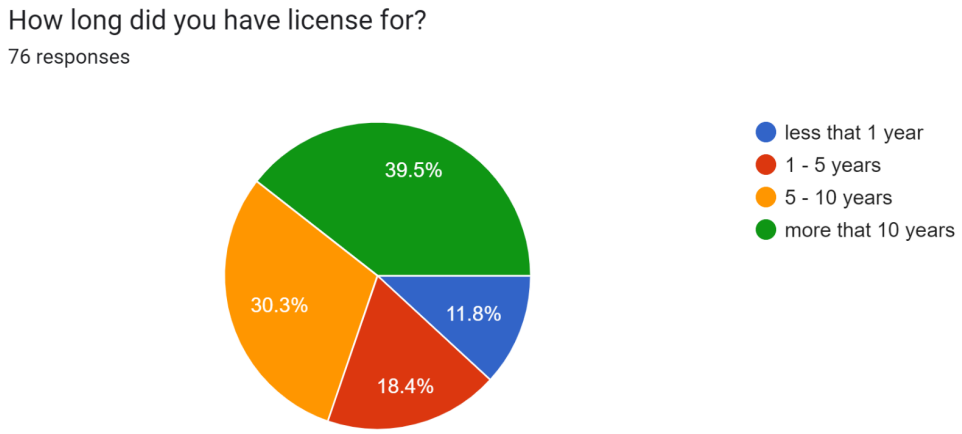
Drowsy driving has become a common danger to many working adults causing a considerable portion of today's car accidents. More than 12 million people in the U.S. suffer from obstructive sleep apnea. Moreover, 37 percent of adults have experienced falling asleep near crossways and high traffic while driving, leading to many close cases of injury.

Section 1: Demographic

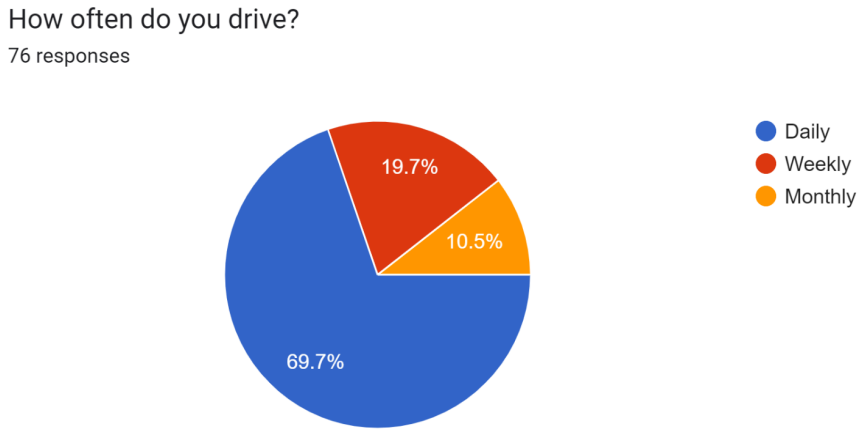
We aim to reach active drivers who drive on a daily basis, typically people who drive early morning or late at night for long hours. We are also asking for information on their driving and sleeping habits that could potentially increase their chances of an accident on the road.



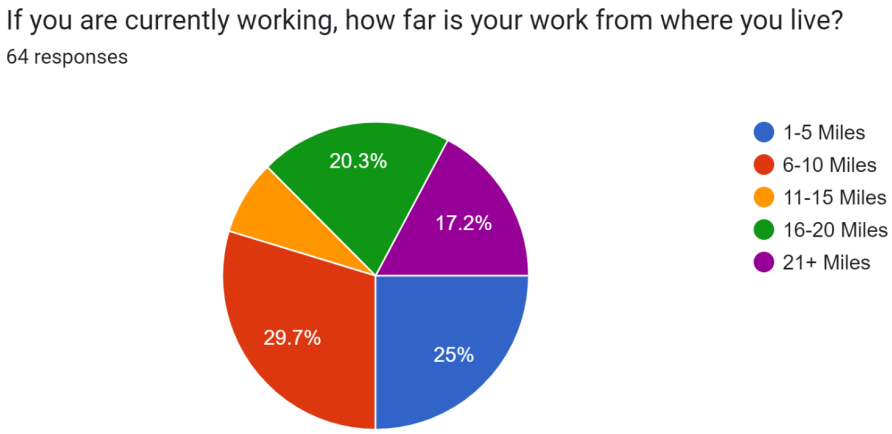
This pie chart shows the age variation for the responses to this survey. It shows that about one-third of those who filled out the survey are 26 to 29 years old, about less, and one-fourth are 17 to 25 years old, around 15 percent are 30 to 35, while the rest range from 40 to 50 plus.



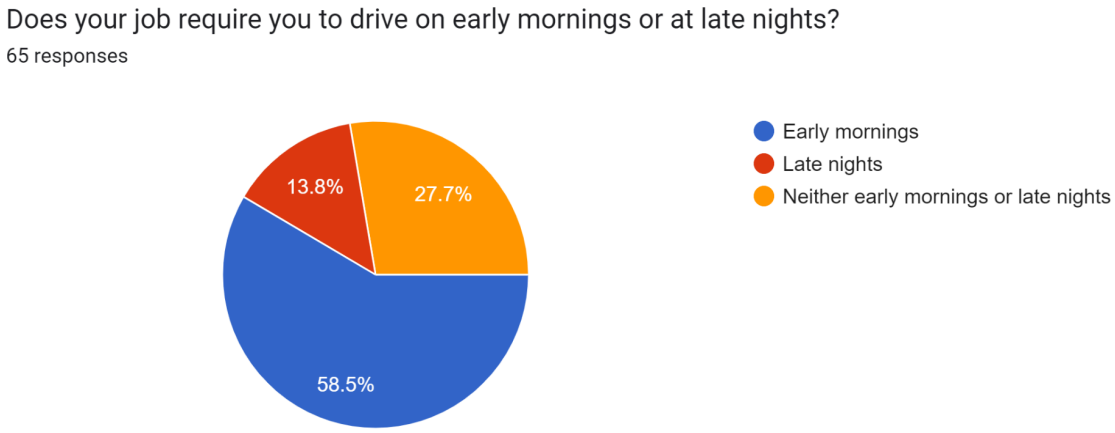
This pie chart shows how long those who filled out the survey have had a driver's license. This is to collect data in relation to how much experience they may have in driving. According to the chart, most of the people (39.5%) in the survey have had a license for more than 10 years, 30.3% had it for around 5 to 10 years, 18.4% had it for 1 to 5 years, and 11.8 % had their license for less than a year.



The pie chart above shows data collected to represent how often they drive. Almost 70% are shown to drive daily, less than 20% are weekly, and about 10% drive monthly.



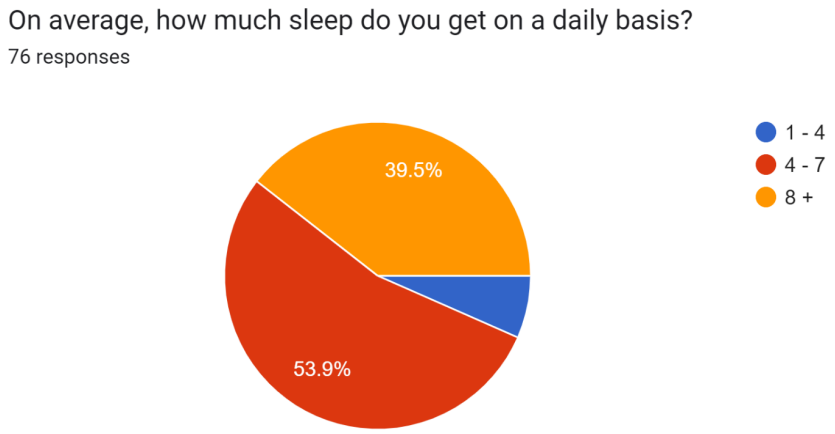
The data above helps show a comparison of the distances that are traveled to their work. One-fourth of the people in this survey travel 5 or fewer miles to their work, about 30% drive 6 to 10 miles, around 7% drive 11 to 15 miles, a little more than 20% drive 16 to 20 miles, and about 17 % drive 21 plus miles.



The pie chart above is used to find data for knowing when they are driving. This can help determine what experiences relate to drowsiness, which they may experience according to the data collected later in the survey.

- What time do you go to bed?

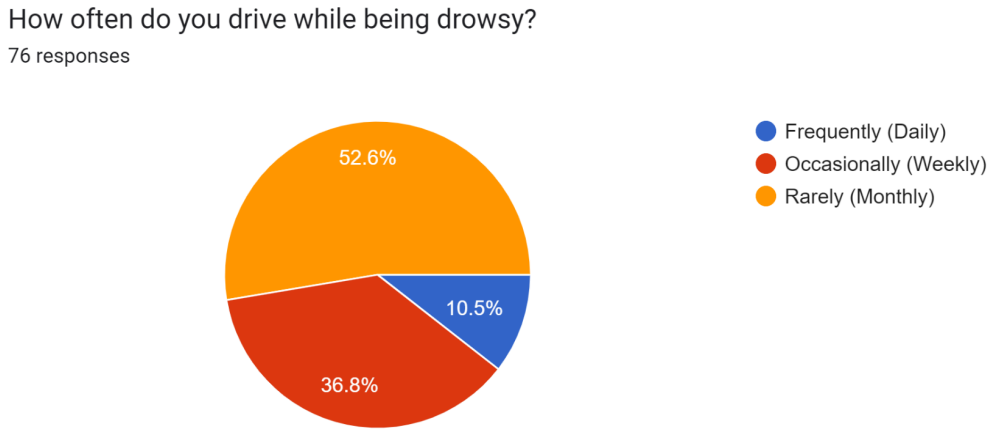
Our survey shows less than a fifth of the participants sleep from 7 to 8 pm, about half sleep between 9 pm to 12 am, and the other fourth sleep from 12 am to 3 am.



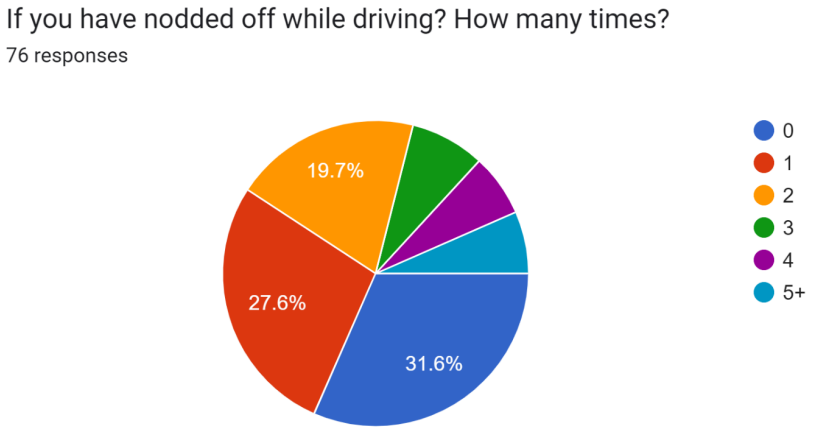
This data is essential because it highlights the root cause of drowsy driving. On average, about 39.5% get 8 hours or more sleep on a daily basis, 53.9% get 4-7 hours of sleep, and 6.5% get 1-4 hours of sleep.

Section 2: Market Questions

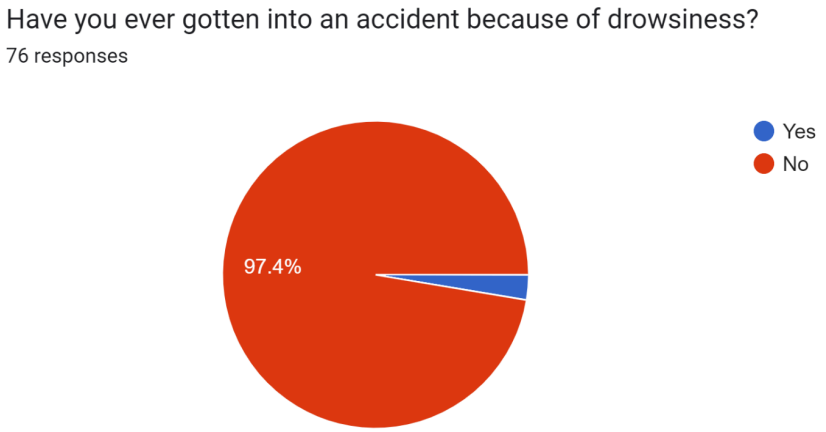
There are no right or wrong answers to this survey. This survey is purely for market research. Data collected from this survey will be used for designing and prototyping a product for the target market.



The data collected shows that 52.6% rarely drive while drowsy, 36.8% occasionally drive drowsy, and 10.5% drive frequently while being drowsy. This is substantial evidence because it highlights the number of drowsy drivers. Drawing from the data, it is inevitable that this is a big problem as a good portion of the drivers drives drowsy either weekly or monthly.



This pie chart shows data collected for how often the survey participants have fallen asleep while driving, which is used to prove the danger of being drowsy. According to the data, about 1/3 have not dozed when driving, another third have at least once, and the last third vary from 2 to 5.



According to the data above, most of the participants in this survey have not gotten into an accident due to drowsiness. This data is collected to know whether drowsiness when driving has caused much damage.

- Have you ever drunk caffeine drinks, and if so, how did that help with your sleepiness?

Many responders mentioned drinking caffeine drinks like coffee but it did not affect their drowsiness. Moreover, they mentioned other methods to prevent their drowsiness, such as music.

- Did you ever use a shock bracelet to help with drowsy driving?
    - If so, do you have any recommendations that could improve the product?

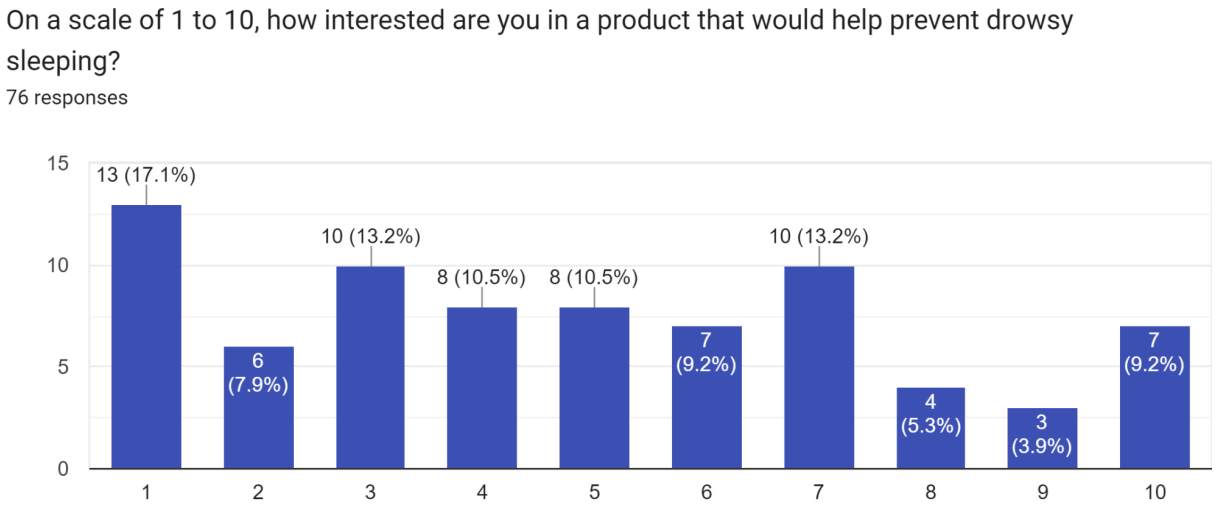
Many of the respondents have never used a shock bracelet. However, the ones that do have a shock bracelet are recommended to increase the intensity of the “shock” of the bracelet.

Section 3: Outcome Questions

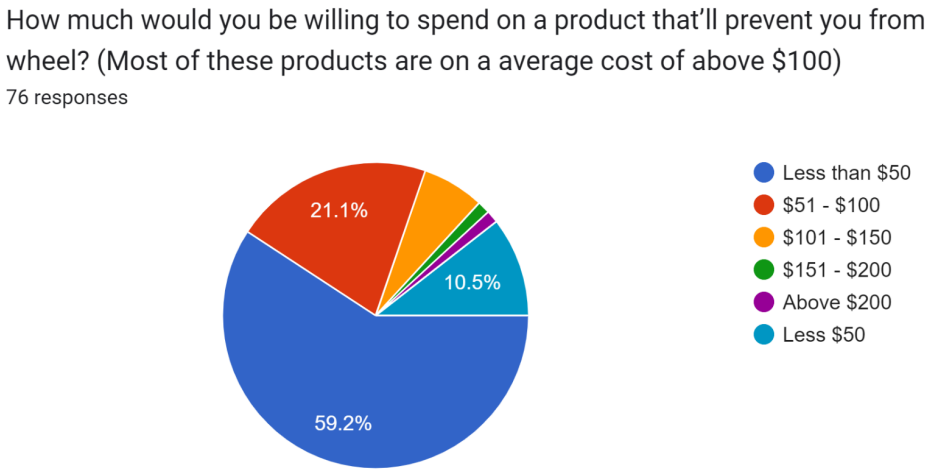
Would you try if a new product was introduced to the market? How important is a new solution to you? How much would you pay for a solution?

- Are you aware of any products worn to prevent drowsy driving other than caffeine-related beverages?

According to the data collected in the survey, the only other type of solution others had for drowsiness while driving were listening to music, opening the window, or a type of caffeine-free energy drink.



The chart above collects the participants' opinions on whether they would be interested in a product similar to what we are creating. According to the data above, the data is greatly varied and shows that most probably that people may have a moderate interest in the product we are going to create



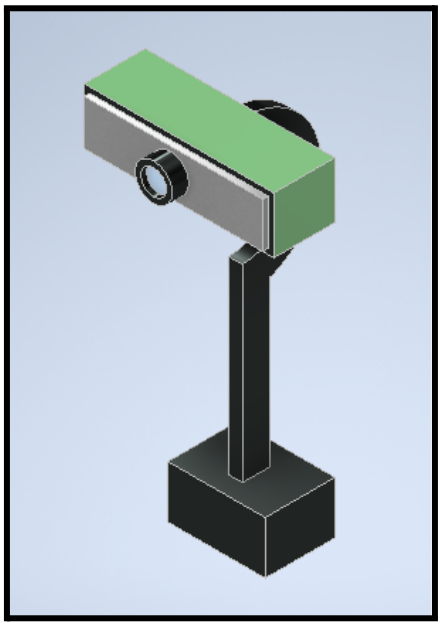
The chart above is intended to know how much people would be willing to spend on a product similar to our creation. This would help determine a cost limit that could be used to create the product and whether there may be a profit. Also, according to the data above, about 70% of the participants are willing to spend less than 50 dollars on a product to prevent drowsiness.

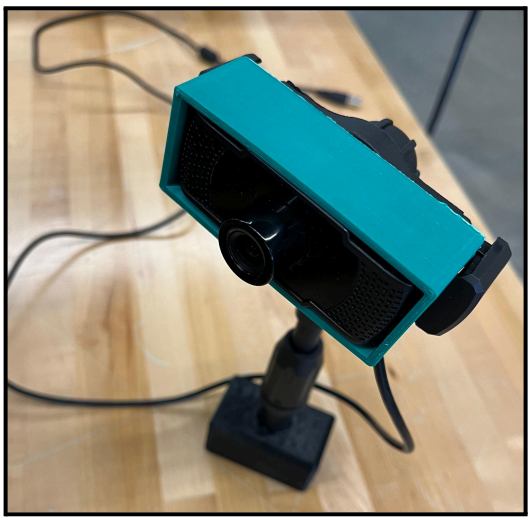
Survey Distribution

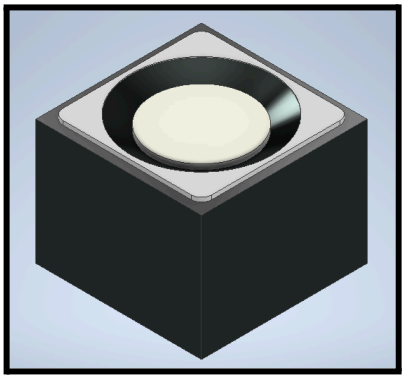
We distributed our survey to the following people using the methods listed below:

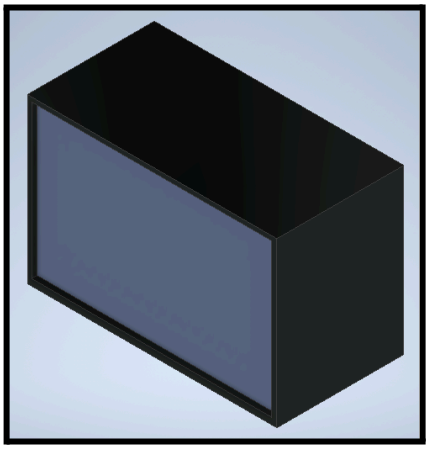
- Traffic Injury Research Foundation (via Google Link)
- Lebanon Trail HS and Heritage HS (via QR code)
- Neighborhood Post Box (via QR code)
- CHP - Truckee Facebook Group (via Google Link)
- Drowsy Driving Victims Of Washington State Facebook (via Google Link)
- Safe Driving School Instagram (via Google Link)
- Frisco Library (via QR Code)

3D Model

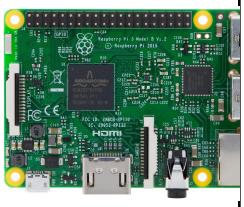
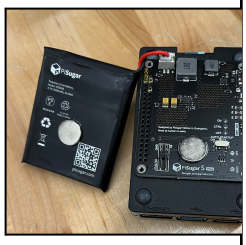


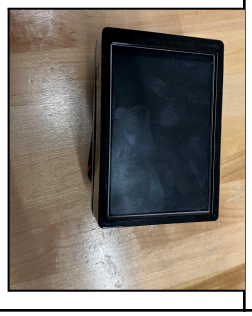






Building Material

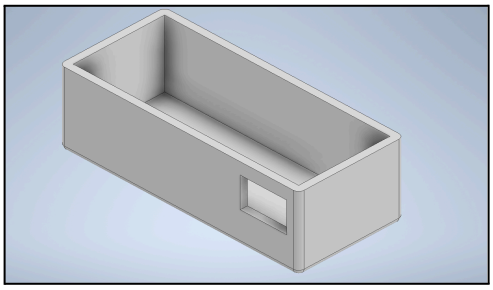
Part	Image	Purpose	Vendor	Price	Quantity	Notes
Raspberry Pi 3B		To contain and perform the code written To keep the Raspberry Pi running the project	Donated / Borrowed	$0 ($45)	1	Raspberry Pi is inside the screen.
Raspberry Pi battery		To contain and perform the code written for the project	Amazon	$25.00	1	The battery allows the raspberry pi to be independent of a cable as the power source.
Audio Speaker		To run the alarm written on our code	Amazon	$15.60	2	NA
Portable Phone Stand		To position the camera towards the driver's face	Amazon	$12.00	1	NA

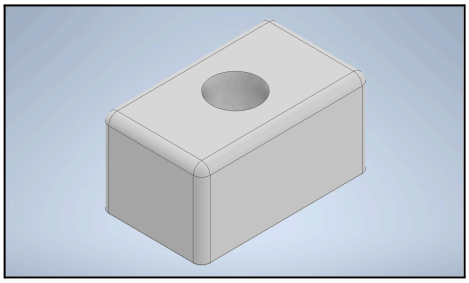
Adhesive stickers		To use on certain components	CVS	$4.00	16	NA
Portable Clip-on Flashlight		Give light to the driver's face when driving in the dark	Walmart	$5.00	2	NA
Raspberry Pi Screen		Allows the user to see his face on the screen when turned on.	Donated / Borrowed	$0 ($34.00)	1	NA

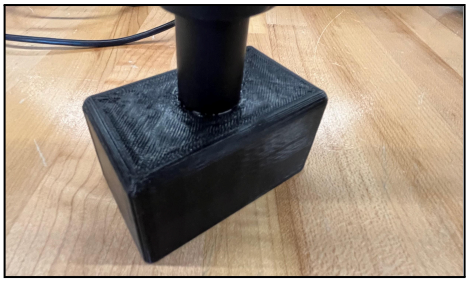
Building Procedure

Elements to keep in mind:
(STEM calculations, theoretical analysis, physics, formulas, etc.)

- First create a base for the stand of the camera and a case for the camera with a small hole on the side of the model for the wire to go out from. This could be done by using any 3d print modeling software.
- Next super glue the base to the stand, fit the camera into its case and connect it to the stand.
    - If you use a different stand, cut off the bottom to an extent where the entire stand is balanced and stable to function
    - The function of the stand is to help the camera be stable and point to the direction of a driver's face and properly detect it







- Power on a raspberry pi by connecting it to your computer or laptop and enter this code into the raspberry pi (we used a raspberry pi 3b)
- Install the necessary plugins needed for the functionality of the code:
    - Imutils, Dlib, cv2

code:from scipy.spatial import distance
from imutils import face_utils
from pygame import mixer
import imutils
import dlib

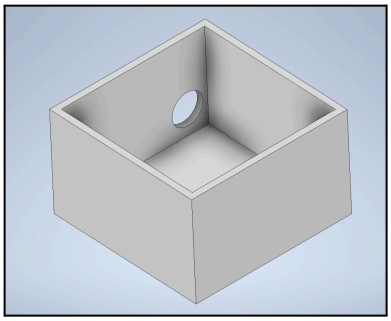
```
import cv2

mixer.init()
mixer.music.load("music.wav")

def eye_aspect_ratio(eye):
    A = distance.euclidean(eye[1], eye[5])
    B = distance.euclidean(eye[2], eye[4])
    C = distance.euclidean(eye[0], eye[3])
    ear = (A + B) / (2.0 * C)
    return ear

thresh = 0.25
frame_check = 20
detect = dlib.get_frontal_face_detector()
predict = dlib.shape_predictor("shape_predictor_68_face_landmarks.dat")

(lStart, lEnd) = face_utils.FACIAL_LANDMARKS_68_IDXS["left_eye"]
(rStart, rEnd) = face_utils.FACIAL_LANDMARKS_68_IDXS["right_eye"]
cap=cv2.VideoCapture(0)
flag=0
while True:
    ret, frame=cap.read()
    frame = imutils.resize(frame, width=450)
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    subjects = detect(gray, 0)
    for subject in subjects:
        shape = predict(gray, subject)
        shape = face_utils.shape_to_np(shape)
        leftEye = shape[lStart:lEnd]
        rightEye = shape[rStart:rEnd]
        leftEAR = eye_aspect_ratio(leftEye)
        rightEAR = eye_aspect_ratio(rightEye)
        ear = (leftEAR + rightEAR) / 2.0
        leftEyeHull = cv2.convexHull(leftEye)
        rightEyeHull = cv2.convexHull(rightEye)
        cv2.drawContours(frame, [leftEyeHull], -1, (0, 255, 0), 1)
        cv2.drawContours(frame, [rightEyeHull], -1, (0, 255, 0), 1)
        if ear < thresh:
            flag += 1
            print (flag)
            if flag >= frame_check:
                cv2.putText(frame, "****************WAKE UP, YOU'RE DRIVING!****************", (10, 30),
                    cv2.FONT_HERSHEY_SIMPLEX, 0.7, (0, 0, 255), 2)
                cv2.putText(frame, "****************WAKE UP, YOU'RE DRIVING!****************", (10,325),
                    cv2.FONT_HERSHEY_SIMPLEX, 0.7, (0, 0, 255), 2)
                mixer.music.play()
        else:
            flag = 0
    cv2.imshow("Frame", frame)
    key = cv2.waitKey(1) & 0xFF
    if key == ord("q"):
        break
cv2.destroyAllWindows()
cap.release()
```

- After installing the code on the raspberry pi, unplug it from your computer or laptop and connect the battery to the raspberry pi.

- Next get a screen for the raspberry pi and attach the two together.
- Connect the camera's USB port to the raspberry pi and wait a few seconds for the screen to turn on.
    - If the screen turns on, but you don't see the camera working, then unplug the battery and re-plug it.



- Print the model of the case for the speaker and fit the speaker into it (use an adhesive sticker of glue)
    - For the speaker, you can first get an aux cord by itself or one from a set of earbuds/headphones. Then solder the wire correctly after splitting the wires inside the cable for the positive and negative sides. Afterward, when the heat from the soldering cools down, you could use wiring tape or another type over the finished soldered piece for safety
- Then connect the speaker to Raspberry
- Connect the battery to raspberry pi and test it

Testing Results

GENERAL INFORMATION			
Test Date:	04/08/23	**Tester:**	Venuja and Manit
Test Case Description:	Test over the positioning and application of code used to function in our product.		
INTRODUCTION			
Requirement(s) to be tested:	The Python code is to be tested with our computer to check its functioning and validity for use on a raspberry pi. Then the code will be tested on the raspberry pi for whether it accurately performs.		
Roles and Responsibilities:	Both of us worked on the code in python, and we both tested our product with each other. Both of us also helped each other in making a model to be used and printed for certain parts of the product. We also divided on what parts to bring in order to complete our product. I prepared speakers, parts for the stands, lighting, etc. Manit bought adhesive stickers and a raspberry pi battery. We borrowed/were donated a raspberry Pi. I mainly helped with the physical aspect of the project after finishing the code together, while Manit helped with printing certain Parts of the model.		
Set Up Procedures:	First, we need to have our code finished, then we need to have all our materials ready in order to build our product. This would help us be able to perform our code into a product to be tested.		
TEST			
Expected Results of Case:	To determine whether our product passed was whether the camera accurately detects our face and performs our code to alarm the user when they are in a state similar to drowsy or asleep. To determine whether it fails would be if the code doesn't perform, function, or even recognize the user's face to continue later programs built into the code.		
ACTUAL RESULTS			
Output Specifications:	To provide our expected values for our test, the camera's positioning system is determined from our code's functioning. Also, the rest of our code needs to work in order for our product to recognize whether its user is drowsy, which then determines whether to sound an alarm. After our tests, the camera accurately detects the user's face and functions the way it is coded to sound an alarm when the user's eyes are closed for a prolonged period of time. Some defect found through our test is that the raspberry pi would not function the code for the camera properly if the camera is upside down, which limits part of how much we can rotate the camera to function.		
Results:	■Pass ☐Fail	**Percentage Passed:**	45/**50 = 90 %**

Project Parameters

Project Parameter	Explanation
Safety	Safe for the user and doesn't does any hazardous reaction when the product is in use
Efficiency	Product functions efficiently, meaning the product reacts quickly to the scenario presented as recorded by the product.
Ease of Use	The product is comfortable to use and can be easily configured when needed.
Cost	The product is more cost-efficient and is a better comparison to buying from more expensive products

Project Recommendations

Recommendation	Explanation
One Component	There could just be one significant component instead of having several add-ons like the raspberry pi, raspberry pi battery, lighting, stand, and webcam.
Eye Recognition While Wearing Glasses.	The product we currently have only functions when both of the eyes are captured. Thus, if someone wore glasses, then it would hinder the code from working.
Eye Recognition In The Dark	The product needs better improvement in working during the dark due to how it currently uses a mini flashlight that aims at the face of the drive, which may irritate them.

Reflection

Thanks to -

Mrs. Altman (our teacher)
Mr. Anand Thakur (our mentor)
CTE Center (place/environment)