Reducing Distracted Driving

Jai Mahajan
Heritage High School

Sri Vamsi Putti
Heritage High School

2022-2023

Engineering Design & Development
FISD Career and Technical Education Center

FRISCO ISD
CAREER AND TECHNICAL EDUCATION CENTER

Table of Contents

“Arrive alive, don't text and drive.”

Project Write-Up

EDD 2022-2023

DISTRACTED DRIVING

VAMSI PUTTI &
JAI MAHJAN

Problem Statement

Utilizing a cell phone when driving or driving while distracted is a dangerous habit that causes drivers all around the world to lose concentration on the road directly in front of them.

80% of car crashes in the US are caused by distracted drivers

Close to 350,000 injuries every year in the US come from these car crashes

Distracted Detector

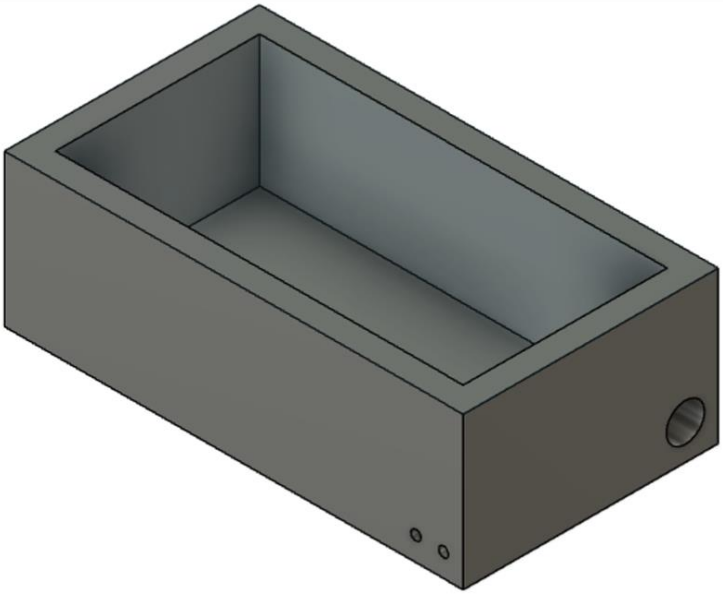
SOULTION

DESCRIPTION

THE DISTRACTED DETECTOR IS A SYSTEM THAT DETECTS WHETHER OR NOT THE USERS HANDS ARE ON THE WHEEL. IF THEY ARE NOT ON THE WHEEL, AN ALARM SOUNDS TO REMIND THE USER TO KEEP THEIR HANDS ON THE WHEEL AND TO BE SAFE.

Project Write-Up

3D MODEL



Project Parameters

-Accuracy
-Affordability
-User-Friendly
-Reliability
-Portability

Driver's hands on wheels must be detected

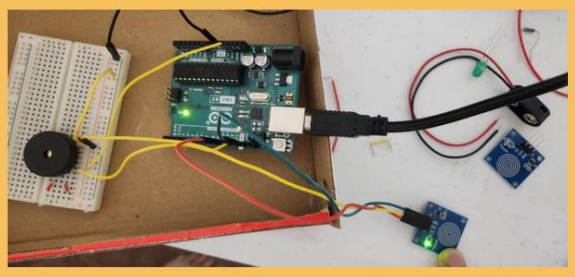
Affordable to all drivers

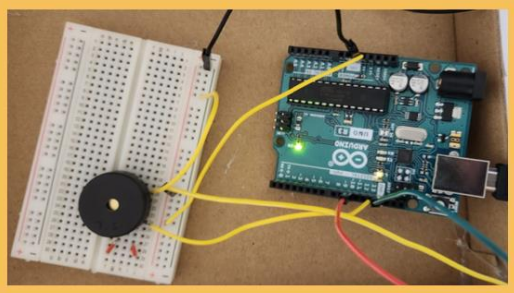
Simple to operate

Long-Term Dependability

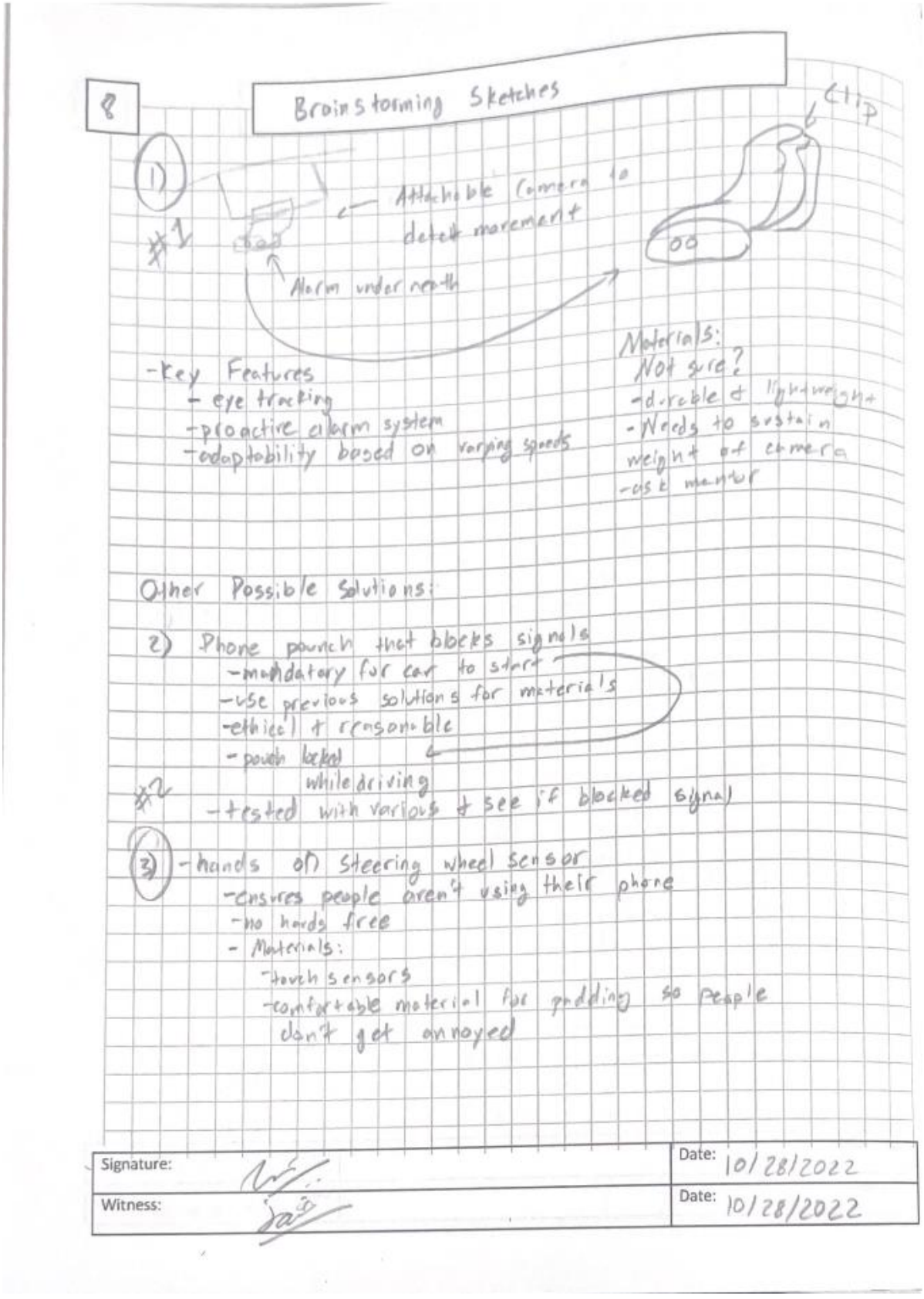
Can be shifted from vehicle to vehicle - Able to adapt to any condition

PHOTOS OF PROTOTYPE





Initial Brainstorming



8

Brainstorming Sketches

1)

#1

Attachable Camera to detect movement

Alarm underneath

Clip

-key Features
- eye tracking
-proactive alarm system
-adaptability based on varying speeds

Materials:
Not sure?
-durable & lightweight
-Needs to sustain weight of camera
-ask mentor

Other Possible Solutions:

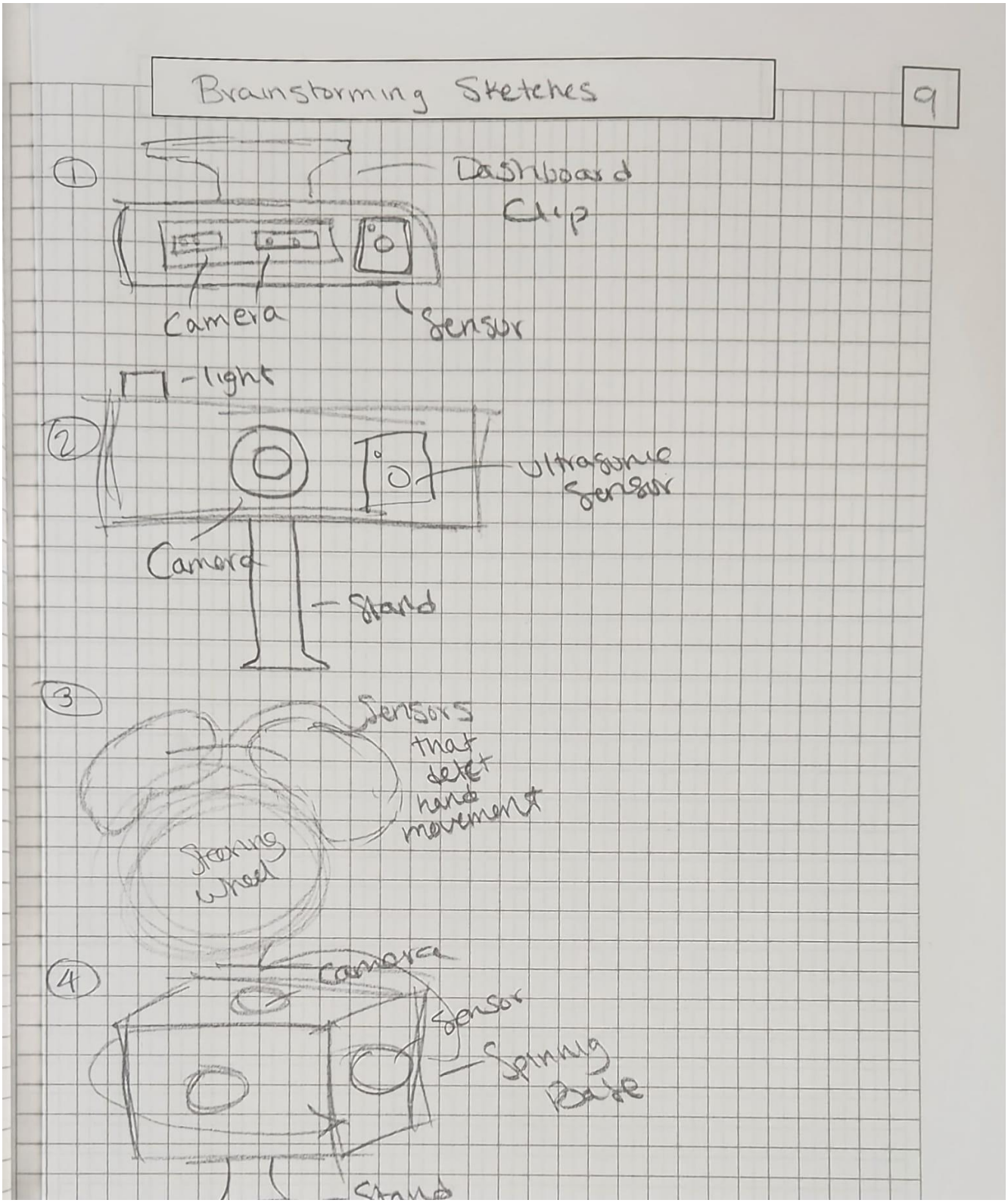
2) Phone pouch that blocks signals
-mandatory for car to start
-use previous solutions for materials
-ethical & reasonable
-pouch locked while driving
-tested with various & see if blocked signal

#2

3) -hands on steering wheel sensor
-ensures people aren't using their phone
-no hands free
- Materials:
-touch sensors
-comfortable material for padding so people don't get annoyed

Signature:	Date: 10/28/2022
Witness:	Date: 10/28/2022

Initial Brainstorming



Attack Path

Problem Statement:

Utilizing a cellphone or driving while intoxicated when driving is a dangerous habit that causes drivers all over the world to lose concentration on the road directly in front of them. From the 2000s, distracted driving has killed innocent people and contributed to around 25% of collisions annually, which is a considerably big portion of yearly crashes. Although most people know how dangerous and prevalent this issue has become, nothing has been done to decrease the rate of distracted driving. Due to the severity of this problem, it must be addressed and prevented.

Health & Safety Justification:

Since 2010 to 2020, the number of accidents that happen due to distracted driving have constantly been above 800,000 accidents in the USA. In addition to this, the average amount of deaths per year due to distracted driving are around 3000 casualties. This causes a big concern with health and safety as people are constantly getting killed and hurt every day. All in all, distracted driving is a health and safety concern due to the large amount of people getting hurt and sometimes even killed every day due to this issue.

https://www.bankrate.com/insurance/car/distracted-driving-statistics/

Economic Justification:

Over 55 billion dollars are spent every year in repair costs in deadly car crashes in the United States of America. Apart from the deadly car crashes, common car crashes cost 44.4 billion dollars per year. These amounts are a very large sum of money and the majority of this money being lost from the people is caused by people that are distracted on the road. Distracted driving causes tens of billions of dollars to be used every day due to the repair costs of vehicles and treatment for victims in a car crash and this number can be reduced drastically if a good countermeasure is taken to prevent distracted driving.

https://www.cdc.gov/transportationsafety/statecosts/index.html
https://safer-america.com/how-much-do-car-accidents-cost-each-year/

Technical Justification:

Despite the 84.7% of people that complain about distracted driving, nothing is being done to prevent this serious issue. When people were asked how dangerous they think distracted driving is, 99% of the participants replied with something along the lines of very dangerous. In addition to this, when distracted driving occurs on the road, there are complaints by the other people on the road due to different reasons. First, other drivers on the road think that there is some danger of being on the road with them. Second, distracted driving negatively impacts traffic flow, which slows down people from reaching their destination. All in all, there are many issues that people complain about distracted driving.

https://www.martininsurance.com/distracted-driving-trend-persists-despite-passenger-complaints/
https://bit.ly/3f66bTH

Justification Articles

Source:

Stavrinos, D., Jones, J. L., Garner, A. A., Griffin, R., Franklin, C. A., Ball, D., Welburn, S. C., Ball, K. K., Sisiopiku, V. P., & Fine, P. R. (2013). Impact of distracted driving on safety and traffic flow. *Accident; analysis and prevention*, *61*, 63–70.

https://doi.org/10.1016/j.aap.2013.02.003

Summary:

As technology has been advancing in our society over the past few decades, the number of distractions that drivers are susceptible to have greatly increased. As a result, many drivers take their attention away from the road, severely increasing their chances of making errors on the roadway, which in turn decreases overall traffic flow and increases chances of major accidents. In order to strengthen these findings, the driving skills of teenagers were assessed with the help of a driving simulation. They were split into three different groups of distractions: texting, calling, and no distractions. These three groups were then separated further into three different traffic simulations: free, moderately congested, and heavily congested. They were assessed on their ability to perform basic driving maneuvers, such as switching lanes or staying under the speed limit. The study seemed to strengthen previous findings regarding the relationship between distracted driving and traffic build up as linear and quadratic regression models portrayed a strong correlation coefficient between the two variables.

Critique:

The article was able to show legitimate evidence of the relationships between distracted driving and traffic buildup through use of multiple, specific treatments. Moreover, the study gives specific statistics and graphs to quantify their findings, which could be used in the future to build off new studies and new discoveries. One weakness of this article was that it didn't really uncover anything new, as it rather just confirmed hypotheses that were already established in the topic's field of knowledge.

Website:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4435680/

Highlighted PDF:

Justification Articles

Source:

Klauer, S. G., Guo, F., Simons-Morton, B. G., Ouimet, M. C., Lee, S. E., & Dingus, T. A. (2014). Distracted driving and risk of road crashes among novice and experienced drivers. *New England journal of medicine*, *370*(1), 54-59.

Summary:

The two most common activities that distract a driver are texting and calling. However, the extent to which one can be distracted by these two activities also depends on the driver's age. Teenagers are more susceptible to losing control of the vehicle when distracted in comparison to adults. To quantify this hypothesis, a study was conducted to measure how well they were able to maintain their driving while distracted and their reflexes in a near crash situation, which was done through a simulation. The 109 drivers who took part in the experiment were between ages 18 and 72. The participants were divided into various groups based on the type of distraction they were experiencing throughout the simulation. After data was collected, the odd ratios for each situation based on the distraction was calculated and confirmed the initial hypothesis. More specifically, the chance of a teenager to crash when they were distracted, on average, was four times as likely than for it to happen to an adult.

Critique:

The article uses the data that it collected well to quantify the specific relationship between age and the effects of distracted driving. It was able to add new information to the current field of knowledge and created new avenues for new research in the area. One weakness of the study of the article was that it didn't really address how the experiment was conducted with specifics; a lot of the information regarding the study was vague and was hard to understand until the Results section.

Website:

https://www.nejm.org/doi/full/10.1056/NEJMsa1204142

Highlighted PDF:

Justification Articles

Source:

Pope, C. N., Bell, T. R., & Stavrinos, D. (2017). Mechanisms behind distracted driving behavior: The role of age and executive function in the engagement of distracted driving. *Accident; analysis and prevention*, *98*, 123–129.

https://doi.org/10.1016/j.aap.2016.09.030

Summary:

Surveys among young adults and elderly seniors have shown that their driving skills are noticeably worse compared to relatively experienced, middle-aged drivers. With so many activities one can accomplish while driving, a study was conducted in order to find if the effects of multitasking have a varying impact based on age. The study consisted of surveys handed out to equally sized age groups of young adults, middle-aged adults, and seniors, which measured their cognitive status through the Behavior Rating Inventory of Executive Function (BRIEF), and their behavior when driving distracted by inquiring on the respondent's usual behavior in certain situations. At the end, the study seemed to find a very strong correlation between age and the effects of distracted driving on driving performance through a regressions analysis. They found that elderly and young adults self-reported more serious mistakes than middle-aged adults did.

Critique:

The article specifically listed out the procedure they went through to calculate their data so that all readers could easily understand the process. Additionally, the literature review of previous studies helps contextualize the problem being discussed with great success. However, there is a possible source of bias within the actual data collection process, as respondents could have easily lied about their distracted driving behaviors.

Website:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5167635/

Highlighted PDF:

Justification Articles

Source:

Dixon, H. B., Jr. (2022). Distracted Driving: Using Technology to Solve a Problem Caused by Technology! *Judges Journal*, *61*(2), 37+. https://link.gale.com/apps/doc/A704028130/AONE?u=j043905007&sid=bookmark-AONE&xid=bb7763a

Summary:

The dangers of using a cell phone while driving are discussed in this article, despite the widespread awareness of these risks. The article begins by stating the survey's findings. Along with the survey, The article then justifies the survey it took and talks about how these systems frequently stop the driver from making or receiving calls, sending texts, or receiving emails while the automobile is moving. Following this, many examples of previous solutions were given and how they function as well as what components are used to make them function in that specific way. After this, the article talked about the concerns of each of the solutions and what could be done to improve them. The conclusion of the article mentions the irony of the solutions to distracted driving. Furthermore in the conclusion, the author finally ends the article by talking about how more solutions will be created every day and they are hopeful that this serious issue will be addressed properly and ultimately solved.

Critique:

The issue of distracted driving is acknowledged in this article, along with its existing solutions. The article presented extensive facts and evidence, offered particular remedies, and discussed their criticisms. These arguments were powerful in demonstrating how little emphasis individuals place on this issue. It could have incorporated a component that offered ideas for potential solutions, but it did not.

Website:

https://link.gale.com/apps/doc/A704028130/AONE?u=j043905007&sid=bookmark-AONE&xid=bb7763ad

Highlighted PDF:

Justification Articles

Source:

Abdulkader, R., Madhan, C., & Jeyashree, K. (2019). They do not just drive when they are driving: Distracted driving practices among professional vehicle drivers in South India. *Indian Journal of Community and Family Medicine*, *5*(1), 34.

https://link.gale.com/apps/doc/A592751791/AONE?u=j043905007&sid=bookmark-AONE&xid=a5c8dca

Summary:

The article begins by talking about the problem at hand, which is the distractions that become prevalent while driving and how it is slowly becoming more of a problem over the past decade. Following the introduction, the article mentions the different types of distractions such as cognitive distractions, and also gives examples of the specific type of distractions. The source of this problem is then mentioned. A cross sectional study was conducted by the authors and the results were presented about how much cognitive distractions impact the people that were a part of the study. Using these results, a conclusion is drawn about the cross-sectional study and different statistics are used to prove that point. After discussing the results, the strengths and limitations of the study were talked about. The authors talked about a more preferred type of study that they could have conducted. Lastly, the article ends with a conclusion section which talks about how common distracted driving is and how it needs to be prevented immediately.

Critique:

Although the article properly talks about the different types of distracted driving, types of distractions, and examples of each one in depth, making the article relevant, the article does not provide an attempted solution about the issue. Furthermore, the authors do not provide a solution that they have come up with.

Website:

https://link.gale.com/apps/doc/A592751791/AONE?u=j043905007&sid=bookmark-AONE&xid=a5c8dca2

Highlighted PDF:

Justification Articles

Source:

Terry, C. P., & Terry, D. L. (2016). Distracted Driving Among College Students: Perceived Risk Versus Reality. *Current Psychology*, *35*(1), 115+. https://link.gale.com/apps/doc/A446003596/AONE?u=j043905007&sid=bookmark-AONE&xid=b49e7d55

Summary:

The article begins with a fact about distracted driving which is even though the number of teenagers who drive while intoxicated has decreased over the past 20 years, distracted driving has proven to be a huge national safety problem. The article study was conducted, in which a sample of around 700 young adults' activity was examined against their opinions of something like the dangers of accidents, cultural influence around cell phone usage when driving, and DWI, which is a common short-form for Driving While Intoxicated. The results revealed that even if participants believed that texting while driving had an equal probability of crashing than driving when drunk, participants were far more inclined to text when driving. As if this is not enough, the young adults also believe that those who are similar to them, such as their colleagues or classmates, are more tolerant of distracted driving than those who are not known to them. This belief also inclines the students to use their cell phones while driving or driving when they are drunk. The article eventually ends by giving the audience a piece of advice when looking for a solution to this problem and states that rather than looking directly for a solution, solves the causes of the problem itself.

Critique:

Although the article correctly provides a study on the causes of distracted driving and the types of distracted driving, such as DWI and CPWD, the article fails to mention a solution that could help solve or prevent distracted driving. Also, the article's study is only on the causes of the problem and not a solution.

Website:

https://link.gale.com/apps/doc/A446003596/AONE?u=j043905007&sid=bookmark-AONE&xid=b49e7d55

Highlighted PDF:

Patent Research

Product Name: Distracted Driving Detector

Patent Number: US 20190236387 A1

Patent Summary: The patent talks about a process utilizing multiple devices that takes in various inputs from the driver, such as eye movements, the angle of the phone within the driver's hand, the light ambience inside the car relative to outside of the car, and other inputs, to determine whether a driver is distracted. Additionally, the patent mentions collecting and storing this data in an external database that could be accessed by the driver to inform them of their behaviors while they are driving. This same database would also be able to compute a certain 'grade', with the use of machine learning, which describes their overall driving performance, indicating areas of weakness so that the driver can take proactive actions to improve them. Overall, the patent aims to establish a process that allows drivers to obtain very accurate information about their driving performances and distracted driving behaviors.

Patent Critique: Although the patent outlines a very thorough process that collects accurate and user-specific information about the driving behaviors, there are no concrete examples of how the process could be implemented. Despite a few mentions of possible embodiments of the patented process, there are no concrete examples of how the entire process could be implemented into a singular device. This leads to the next issue: the devices mentioned to implement the process are too complex for a user to use. There are some parts of the process that are redundant and are not necessary for a complete evaluation.

Images:

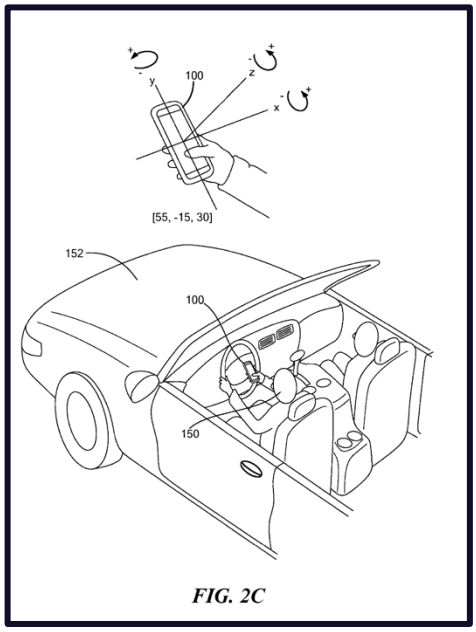


FIG. 2C

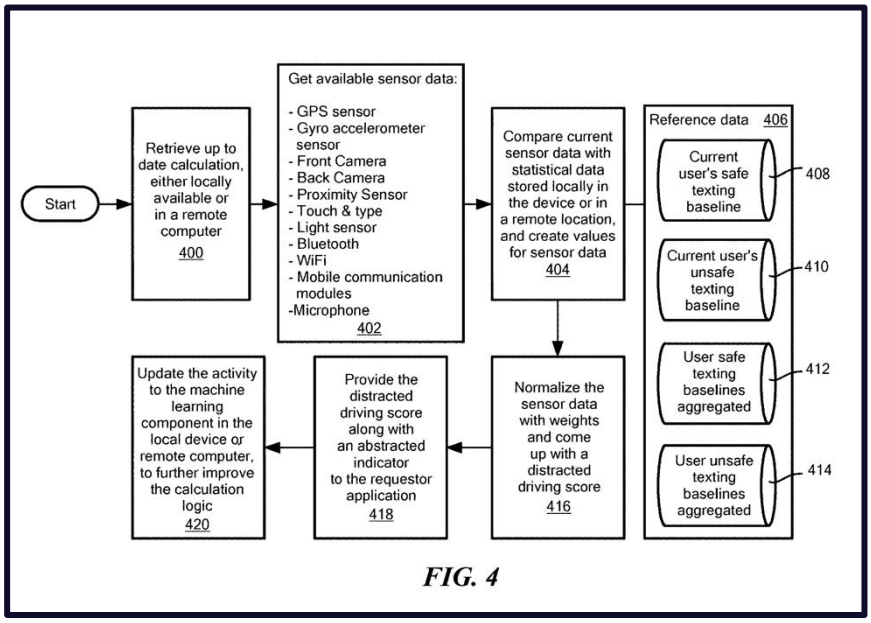


FIG. 4

Patent Research

Product Name: Distracted Driving Violation Detection and Reporting Technology

Patent Number: US 20150363650 A1

Patent Summary: The patent includes a device that is able to take photographs of the car's license plate, driver, and other crucial information for identification and immediately use these photographs to file and send a citation to a nearby law enforcement office. The device will be able to fill out the necessary information of the citation by reading information from the photograph with the help of various optical character recognition processes. The device will then be able to send this citation to nearby law enforcement offices via radio waves, LAN, LAN Wireless, and other similar mediums. Additionally, all of this data will be stored in a cloud database, so each citation generated will be specific to the driver that was caught. The inventor justifies that this device will help reduce distracted driving by scaring drivers into paying more attention on the road due to these devices being able to easily catch driver's red handed and make them face the appropriate punishment.

Patent Critique: The patent outlines a very thorough process that the device will accomplish to file citations so that distracted drivers face the punishment that they deserve. However, the device doesn't really seem to have a way to identify distracted driving in the first place. This patent is very ineffective by itself, and would need to work together with another device in order to be able to fully accomplish the task. Although the inventor hints at bystanders taking pictures of cars and their license plates to allow for the device to perform its function, the risk of human error associated with this method is too high for it to be a viable solution to this flaw in the device.

Images:

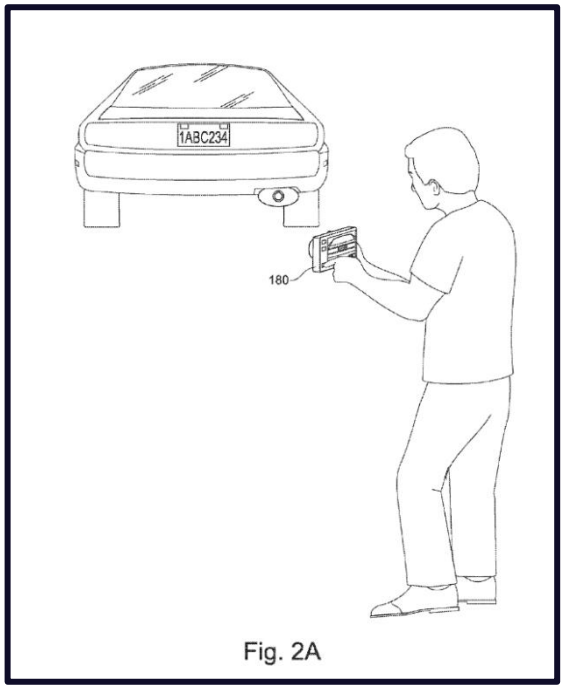


Fig. 2A

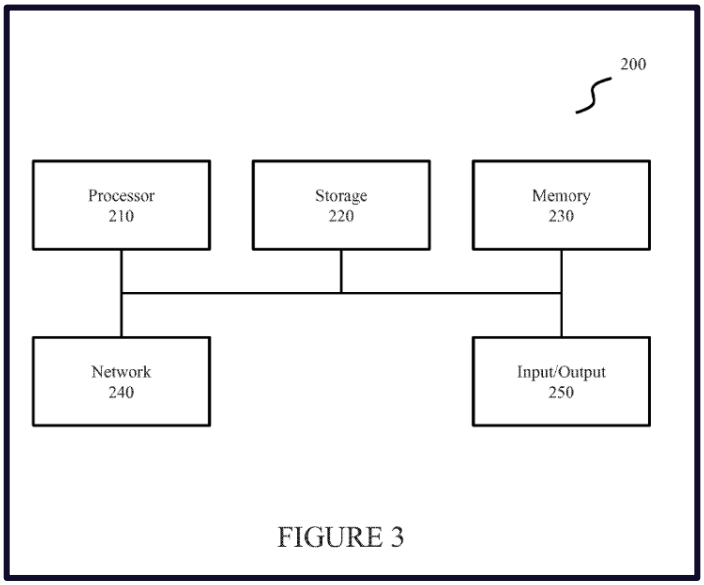


FIGURE 3

Patent Research

Product Name: Apparatus, System, and Method for Preventing Distracted Driving

Patent Number: US 20160014263 A1

Patent Summary:

This patent shows the design of a system that can be used in automobiles that will be used when the car is in action. This invention monitors the behaviors of the driver when the vehicle is operating. After the destination is reached, the device records the behaviors and displays them to the driver. The driver can then notice when he/she gets distracted and fix their behavior to prevent it from happening the next time. Following this description, the inventors show the diagrams of the module and label it with very detailed information about what each specific component of the invention is.

Patent Critique:

This patent uses a device that has to be hand-held or rested on some surface rather than implemented into the car itself, making it quite difficult to move around and use in general. In addition to this, the invention itself is quite big and box-shaped, again making it difficult to transport and move. The patent's device requires an external power source to power up and record/monitor the driver's behaviors which are uncommon in today's society. Lastly, the device does not use AI or ML to monitor the true behaviors of the driver, but only predicts them, which results in some of the behaviors recorded being inaccurate.

Images:

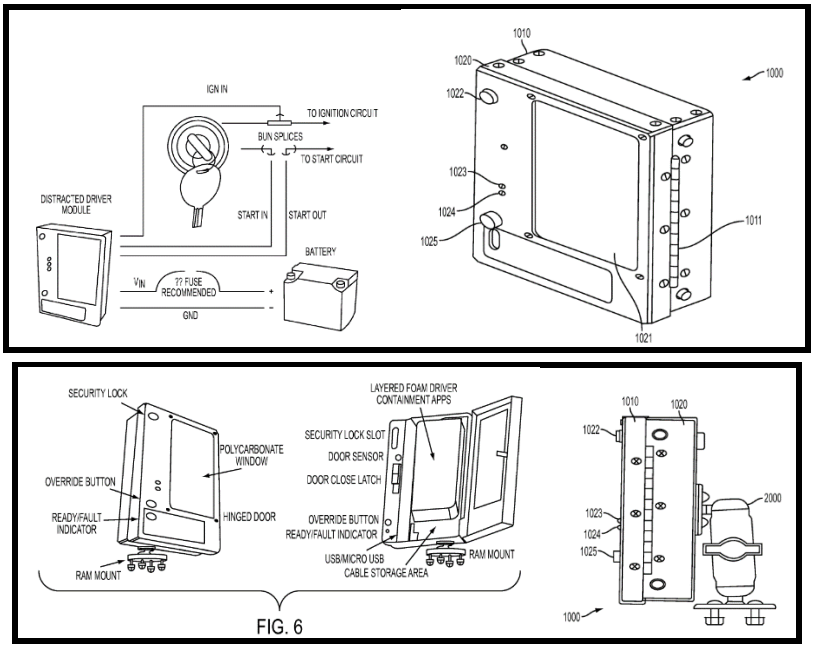


FIG. 6

Patent Research

Product Name: SAFETY SYSTEM TO PREVENT OR DECREASE DISTRACTED DRIVING CAUSED BY THE USE OF A CELL PHONE IN A VEHICLE

Patent Number: US 20150230042 A1

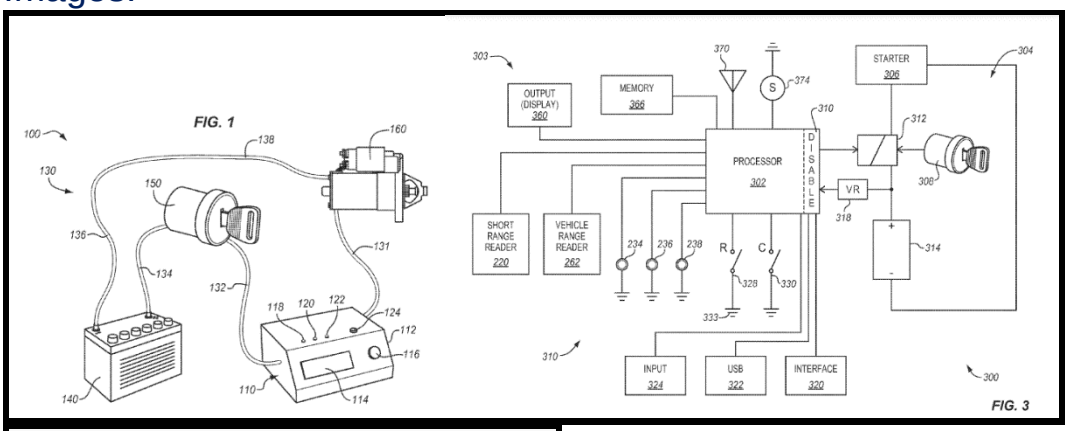
Patent Summary:

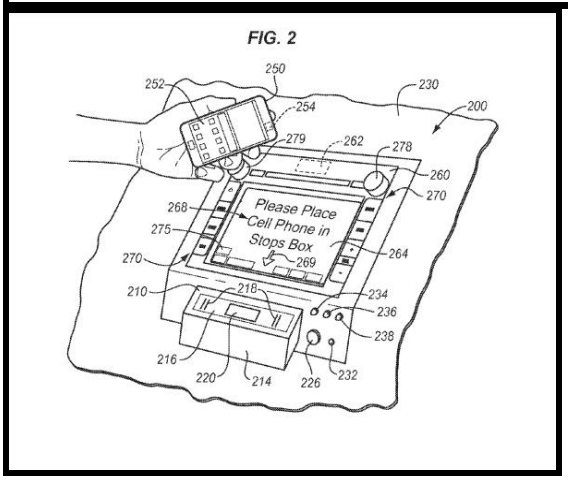
The patent design is about a box that you can put your phone into that is connected to the car in order to reduce or prevent distracted driving by the use of a cell phone. The invention is a box that is attached to the dashboard of your car and allows you to put your phone inside it. The box remains locked until your drive is completed which you can then open and collect your phone and continue using it like normal.

Patent Critique:

The patent uses a device that stores the phone in a locked box. If there is some sort of emergency in which the person in the car needs access to the phone, they can not unlock it until the car's engine has stopped running. In addition to this, the box is not compact by any means and therefore takes up quite a lot of space. Also, the lock on the box is electronic and is turned on and off by the car keys but if there is a malfunction with the box for whatever reason, it will be difficult to open the box with your phone inside it.

Images:





Similar Products Matrix

Distracted Driving

	Authoritative Source	Image	Solution Name	Cost	User-friendly	Effectiveness	Durability	Adaptable	Aesthetic	Source
1	CellSlip - Through Amazon		RFID Signal Blocking Cell Phone Pouch	$15						https://www.amazon.com/CellSlip-Signal-Blocking-Phone-Pouch/dp/B0963DBMXC
2	Katasi		Groove	$25						https://katasi.com/
3	Ford		MyKey	$30						https://www.ford.com/support/how-tos/keys-and-locks/mykey/mykey/
4	Bosch		Interior Monitoring Systems	$270.00						https://www.bosch-mobility-solutions.com/en/solutions/interior/interior-monitoring-systems/
5	Nicevvvv - Amazon		Cellcontrol Drive ID	$50						https://www.amazon.com/Cellcontrol-DriveID-Distracted-Driving-Prevention/dp/B01342QA4A/ref=cm_cr_arp_d_product_top?ie=UTF8
6	Loewten - Walmart		Car Anti Sleep Alarm	71.16						https://www.walmart.com/ip/Safe-Driving-Alert-Car-Anti-Sleep-Alarm-Alarms-For-Driver-Professional-Use-General-Purpose-Car/14793017792

Excellent

Very Good

Good

Fair

Poor

Data Collection

Problem Statement:

Utilizing a cell phone or driving while intoxicated when driving is a dangerous habit that causes drivers all over the world to lose concentration on the road directly in front of them. Since the 2000s, distracted driving has killed innocent people and contributed to around 25% of collisions annually, which is a considerably big portion of yearly crashes. Although most people know how dangerous and prevalent this issue has become, nothing has been done to decrease the rate of distracted driving. Due to the severity of this problem, it must be addressed and prevented.

Section 1: Demographics

We are hoping to reach out to people who are able to legally drive between the ages of 18 and 50 years old because studies have shown that this age group is more likely to be distracted while driving than elderly seniors(ages 50+). Additionally, we plan on asking for information regarding how often they drive and the type of cars they drive.

- Do you currently have a driver's license or learner's permit?
- How old are you?
- How many people in your family drive?
- On a scale of 1 to 10, how often do you drive?
- What types of cars do you usually drive? (EV, SUV, van?)

Section 2: Market Questions

We need to gather data on the distractedness of a typical driver from ages 18-50. With the increase in cell phone usage, the number of people using their technological devices while driving has drastically increased, and therefore the most important feature is the number of times a cell phone has been used and how often the driver drives while intoxicated. In addition to this, we would like to know if they have been aware of this problem and if they have seen it around them.

- What devices do you typically bring with you while you drive?
- On a scale of 1 to 10, do you think you are usually distracted by the following distractions while driving? (Text messages, food, calls, etc.)
- What features do you think are necessary to make an effective solution to distracted driving?
- Have you ever bought products that help you focus more on the road?
- If applicable, what products have been bought to help you focus on the road? Please list the price, function, and name, if possible.
- Have you ever been a victim of distracted driving?
- Have you witnessed someone become a victim of distracted driving?

Section 3: Outcome Questions

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

Distracted driving leads to a total of close to one million accidents and yet there are over hundreds of millions of people that are unaware of this problem. An effective solution is needed to help solve this problem and reduce the number of accidents that occur all over the world.

- On a scale of 1 to 10, do you see yourself purchasing a device that alerts you when you are not maintaining eye contact on the road?
- How much money would you be willing to spend on the device mentioned above?
- Do you think it's important for people to invest money in these devices?

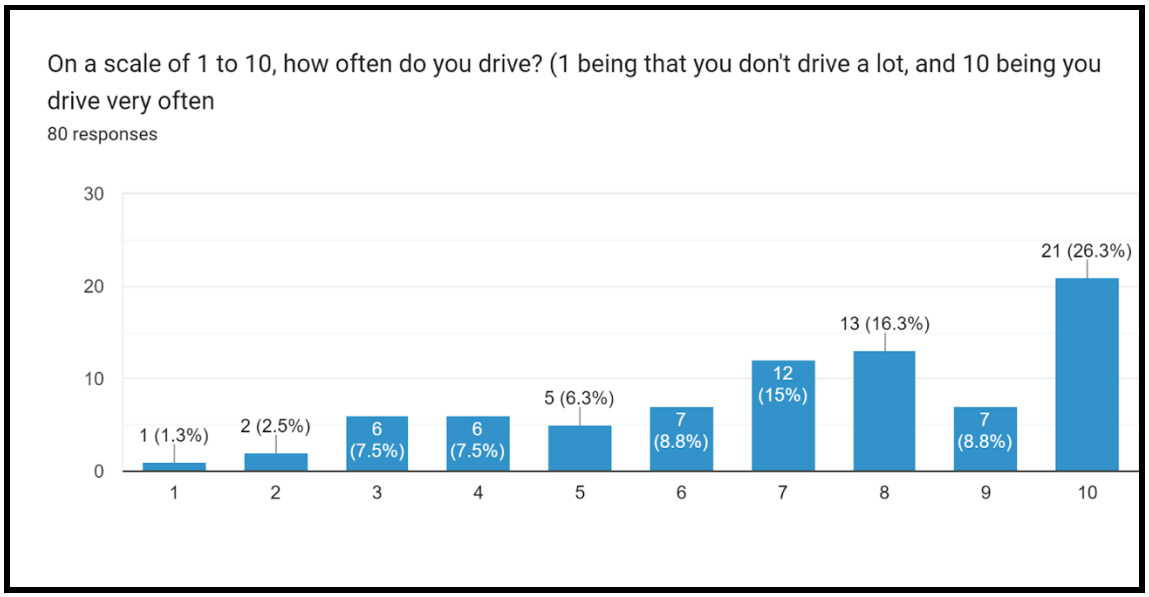
Survey Distribution

In order to get the data we want, we need to ensure that we're reaching the right target audience and gaining enough responses to tell us what we need to know.

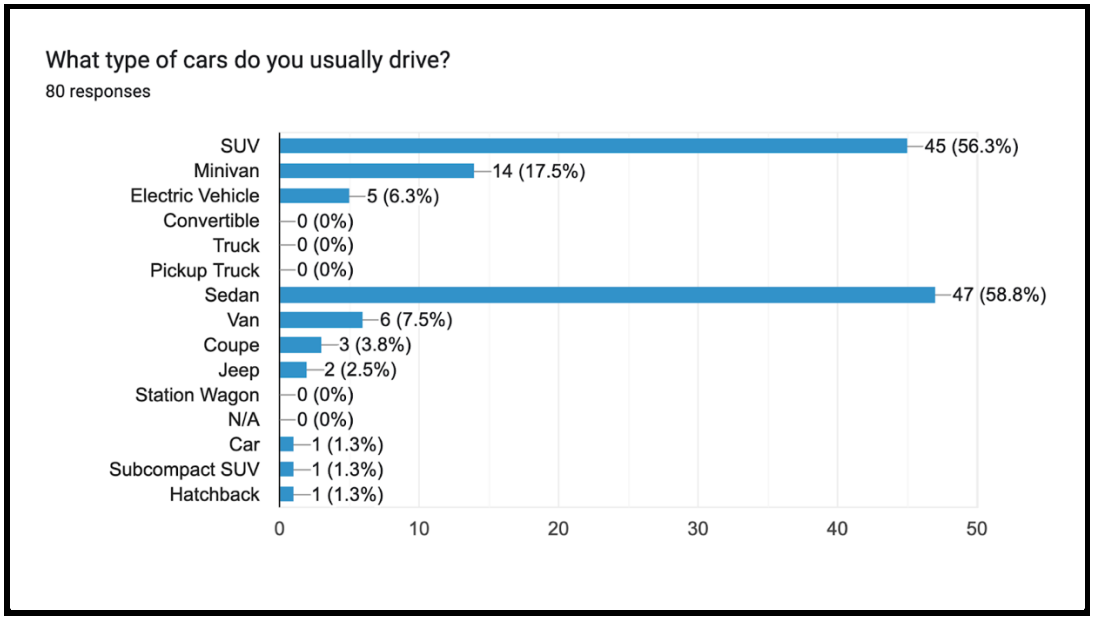
We distributed our survey to the following people using methods listed below:

- Women of Westridge Facebook Group (via Google link)
- HAWK HOA WhatsApp Group (via Google link)
- Heritage High School Building (via QR code)
- DFW Driving School Building (via QR code)
- AP Seminar and Research classrooms (via QR code)

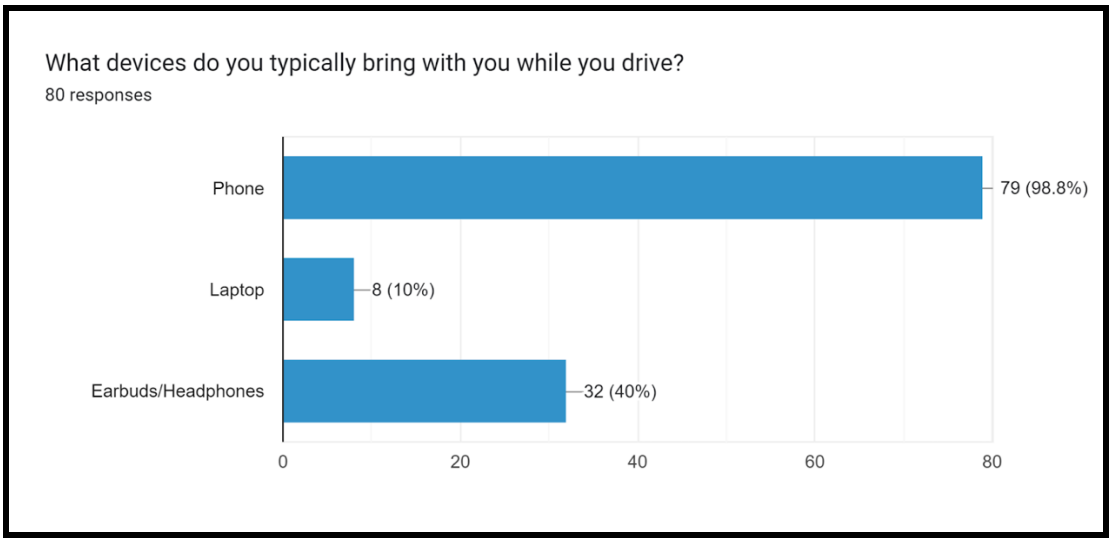
Survey Results



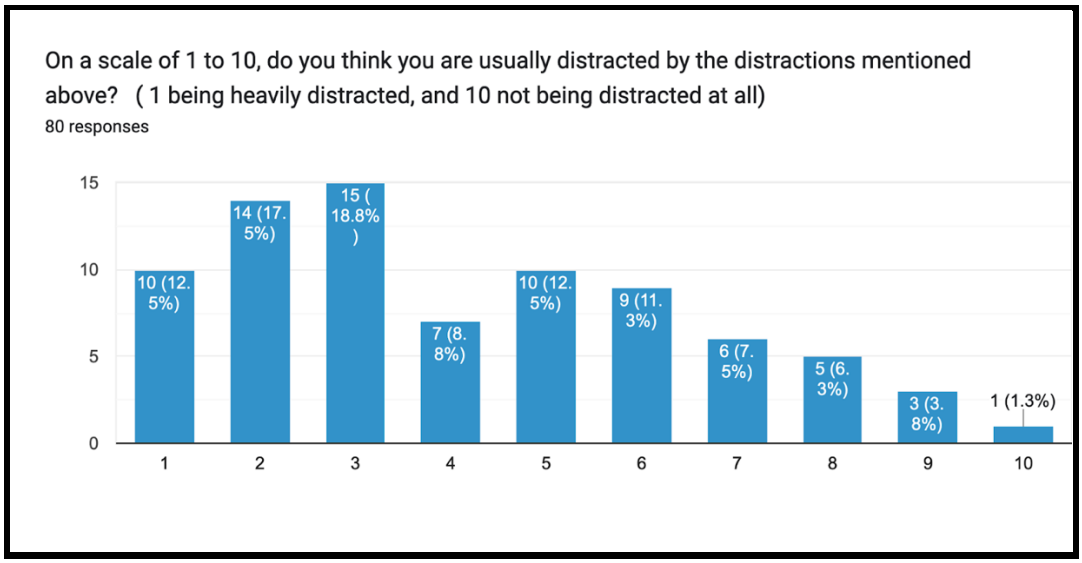
When asked how often they drive on a scale from 1 to 10, 53 out of the 80 people that responded to our survey chose 7 or higher. This means that approximately 66.25 percent of people that responded to the survey drive pretty regularly on a day-to-day basis, demonstrating that there is a large target market that could be positively affected by a solution to distracted driving.



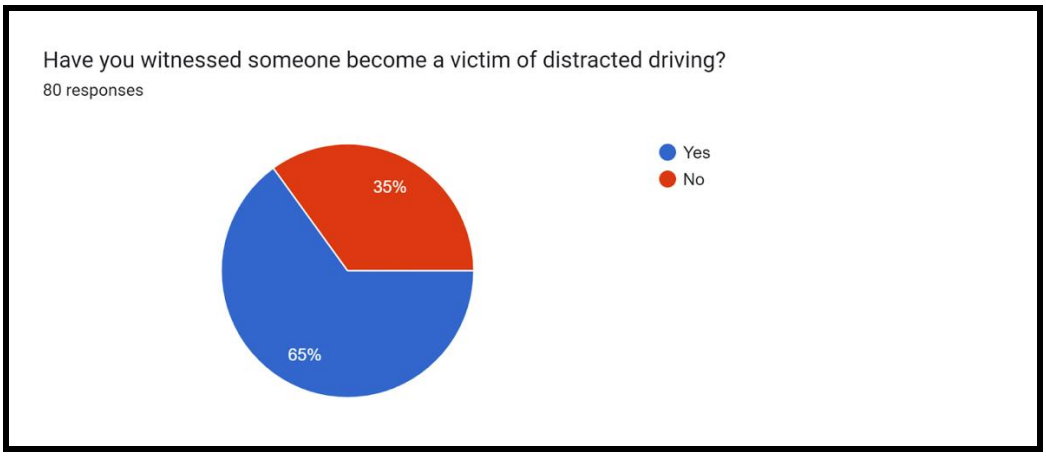
When asked about the type of car that the respondent drives regularly, the most prevalent responses were an SUV, Sedan, and Minivan. Background research has shown that as the size of the car increases, they are more likely to crash and cause more damage. These results show the great need to solve this very prevalent issue because the faster the problem is solved, the fewer crashes and damages there will be.



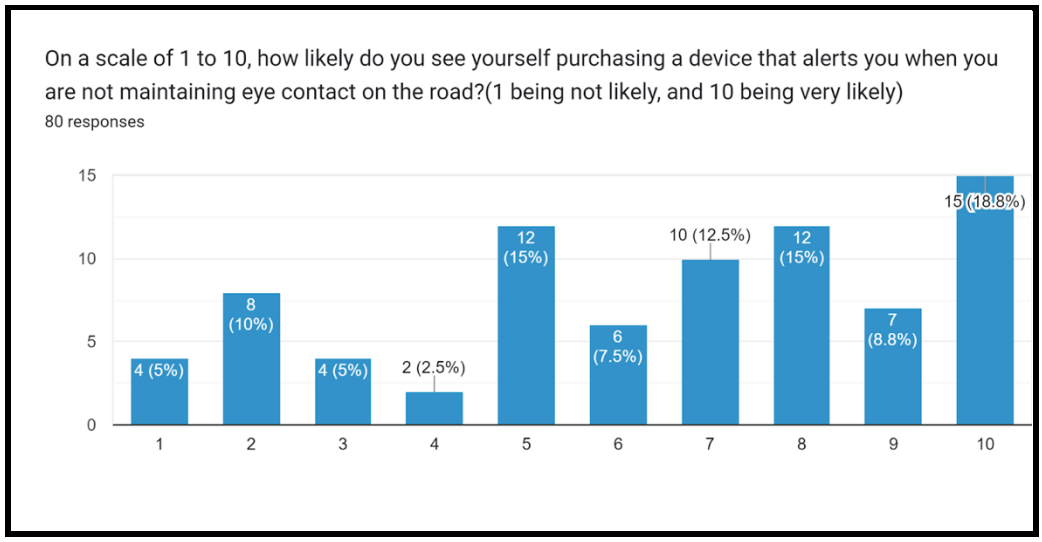
Out of the 80 drivers that responded to our survey, 98.8 percent of the drivers (79 people) brought a mobile device with them while they drove. This extremely high number of drivers that bring phones with them consequently results in a high probability of these same drivers being distracted by these devices while driving.



When asked how often one is distracted by technological devices, on a scale of heavily distracted to not distracted, 88% of the respondents chose a value from one to seven, which admit to being distracted before, and therefore causing danger to others on the road. This further demonstrates the severity of the problem as many people are being affected by it.

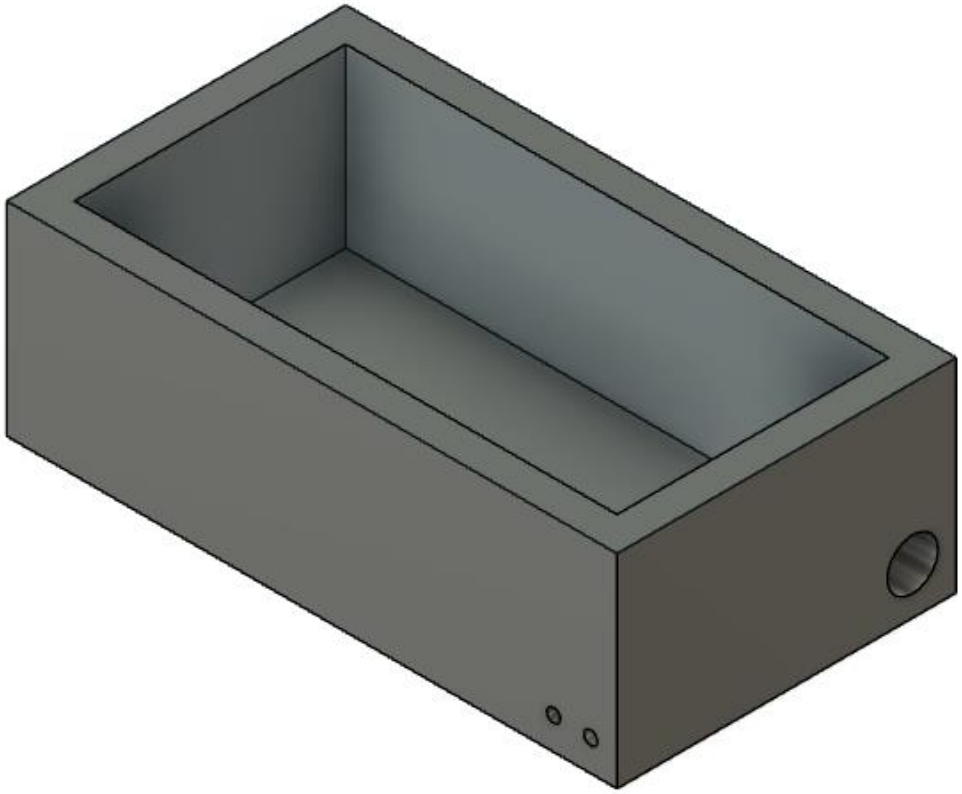


Over 60 percent of people surveyed have witnessed someone become a victim of distracted driving, emphasizing the significance of this issue and demonstrating a need for a solution due to the majority of people being affected by this problem.

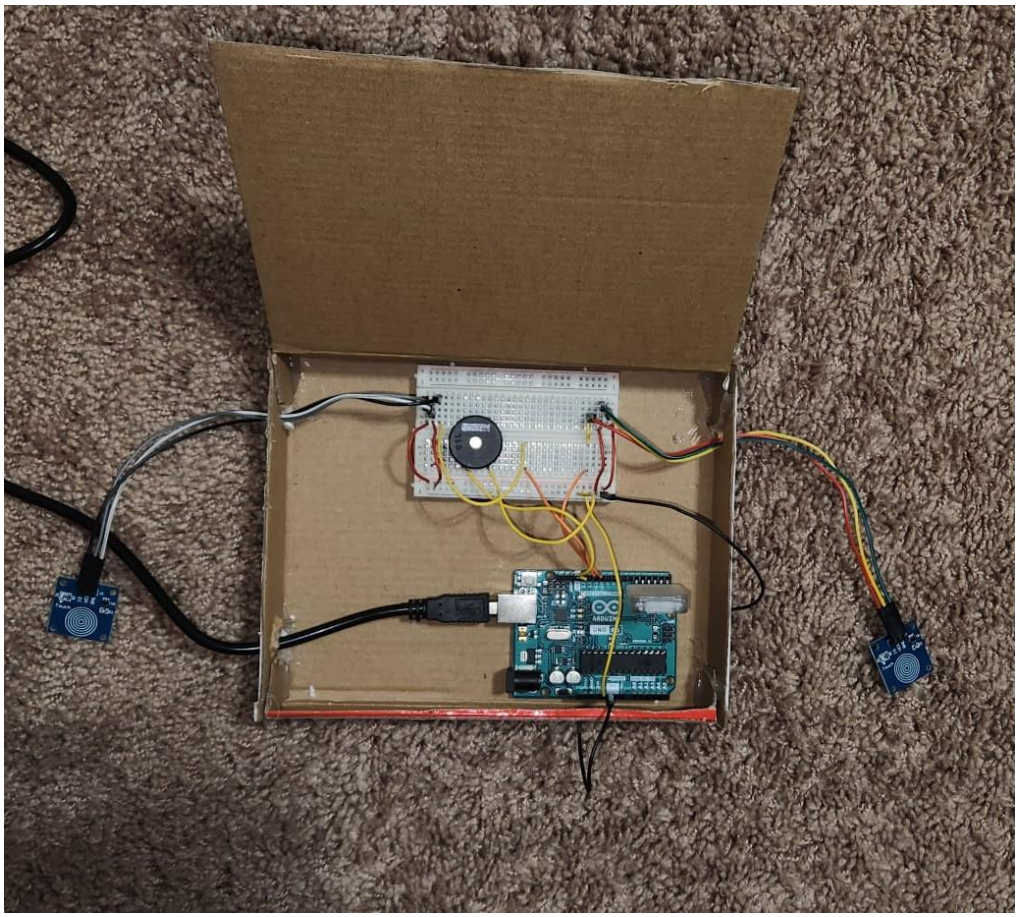


When asked if they would be interested in purchasing a device that alerts them when they are not making eye contact with the road, 50 out of the 80 respondents chose a number 6 or higher. In other words, over 60 percent of the respondents would more than likely spend money toward a solution to the issue of distracted driving, further demonstrating the importance and necessity of this product within the target market.

3D Model

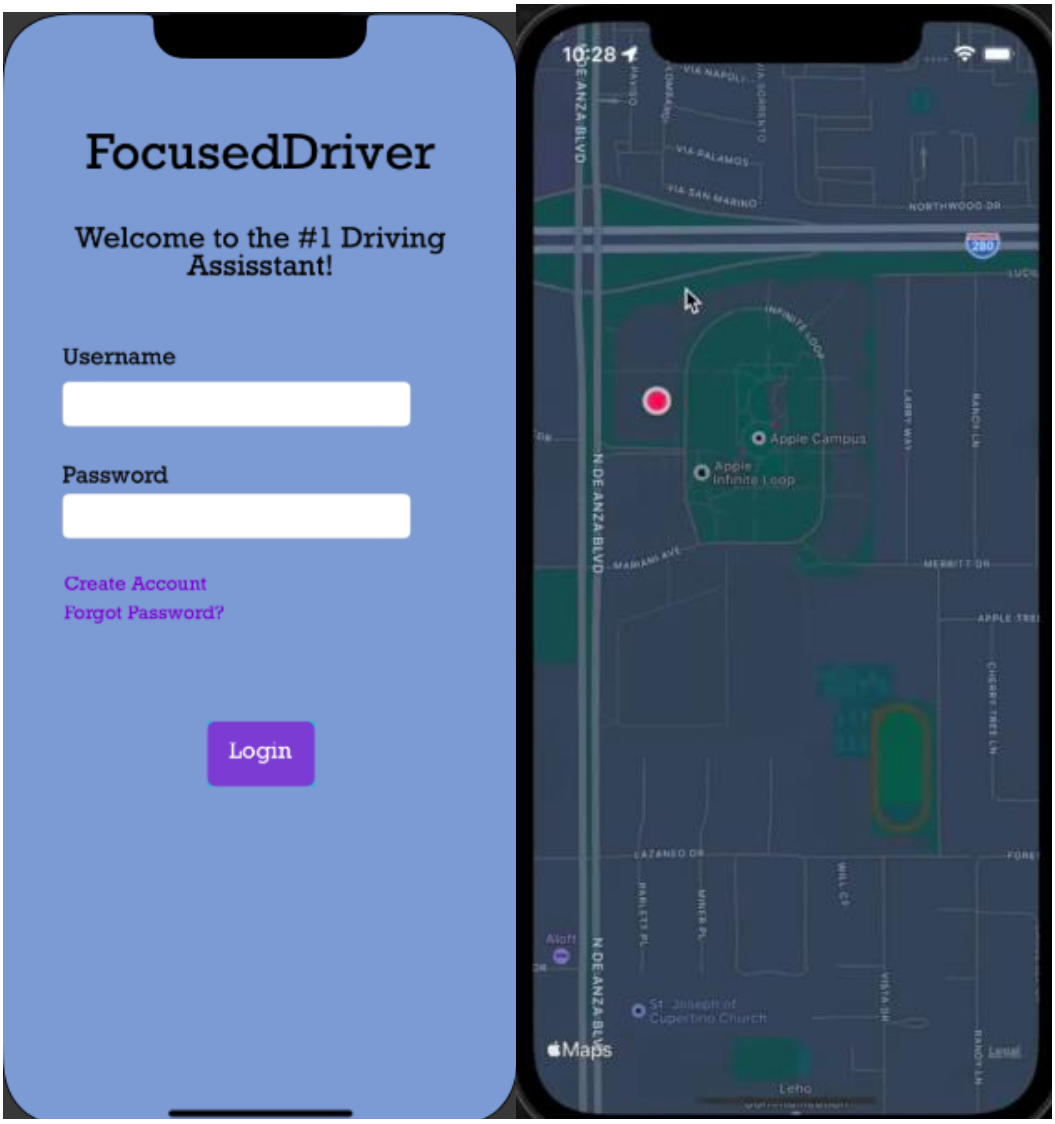


Final Product



The physical hardware portion of the Distracted Driver is shown above. The device uses an Arduino Uno R3 microcontroller to achieve the task of deciding if the driver's hands are off the wheel. More specifically, this done using the capacitative touch sensors on either side of the microntroller/breadboard. To alert the driver that the hands are actually off the wheel. These sensors will be attached to the back of the very right and left sides of the steering wheel. The main compoenents will sit on the portion of the car that extends the steering wheel to the driver. The microncroller also has a Bluetooth module that is able to transmit data from the controller to the mobile application, which will be discussed more on the next page.

Final Product



The software component of the Distracted Detector is the Focused Driver app that allows users to measure how often they are distracted on a quantitative scale. The app allows the user to generate an account with a custom username and password that stores user-specific data thanks to the UserDefaults API that is built into Swift/Xcode. Once logged in, the user can see the exact speed they are traveling at and a graph that shows the user's activity over a period of time. These features are generated using the data that the microcontroller transfers to the application using the Bluetooth module.

Building Materials

Materials List

PLTW | Engineering

Project Title: Distracted Driving Detector

Part	Image	Purpose	Vendor	Price	Quantity
Cardboard		Material for box being made to hold components of the build	Office Depot	$1	3
Piezzo Buzzer		Alarm of the component	Allied Electronics	$10	1
Capacitive Touch Sensors		Touch Sensors that will detect if the hands are on the build or not	Walmart	$9 for 6	1
Bluetooth Module		This component will be responsible for extracting data from the component to the app on your phone	Fry's Electronics	$8	1
Wires + Breadboard		Base of the component, responsible for ensuring the product works	Walmart	$12	1

Building Procedure

Section 1: Arduino Component

1. Gather the hardware components: In addition to the capacitive touch sensor, microcontroller, power supply, and alarm, you will also need jumper wires, a breadboard or a prototyping board, and a USB cable.
2.

b. Create the basic alarm component of the hardware build. Connect the VCC pin of the sensor to the 5V pin of the microcontroller, connect the GND pin of the sensor to the GND pin of the microcontroller, and connect the OUT pin of the sensor to a digital pin of the microcontroller which will later attach to the bluetooth module.

bi. Connect the alarm: Connect the positive wire of the alarm to a digital pin of the microcontroller using a jumper wire, and connect the negative wire of the alarm to the GND pin of the microcontroller.

c. Connect the microcontroller to the power supply and the alarm: Connect the microcontroller to the power supply using a USB cable or a battery. Connect the alarm to a digital pin of the microcontroller using jumper wires.

d. Build the circuit: Build the circuit on a breadboard or a prototyping board, using the jumper wires to connect the components. Make sure that the connections are secure and there are no loose wires. Finish the circuit by adding the touch sensor and bluetooth module to the breadboard by repeating the steps in part c.

2. Here we start to code the arduino microcontroller
    1. Connect your Arduino board to your computer using a USB cable.
    2. In the Arduino IDE, go to File -> New to create a new sketch.
    3. In the new sketch, declare two integer variables to store the digital pins that are connected to the touch sensor and alarm.
        1.
```
const int touchPin = 2; // the digital pin connected to the touch sensor
const int alarmPin = 3; // the digital pin connected to the alarm
```
    4. In the setup() function, use the pinMode() function to set the touchPin as an input and the alarmPin as an output.
        1.
```
void setup() {
  pinMode(touchPin, INPUT); // set the touch sensor pin as an input
  pinMode(alarmPin, OUTPUT); // set the alarm pin as an output
}
```
    5. In the loop() function, use the digitalRead() function to read the value from the touch sensor. If the value is HIGH, meaning that the sensor has been triggered, use the digitalWrite() function to turn on the alarm by setting the alarmPin to HIGH. Then, use the delay() function to wait for one second, and turn off the alarm by setting the alarmPin to LOW.

```
void loop() {
  int touchValue = digitalRead(touchPin); // read the value from the touch sensor
  if (touchValue == HIGH) { // if the touch sensor is triggered
    digitalWrite(alarmPin, HIGH); // turn on the alarm
    delay(1000); // wait for one second
    digitalWrite(alarmPin, LOW); // turn off the alarm
  }
}
```

1.

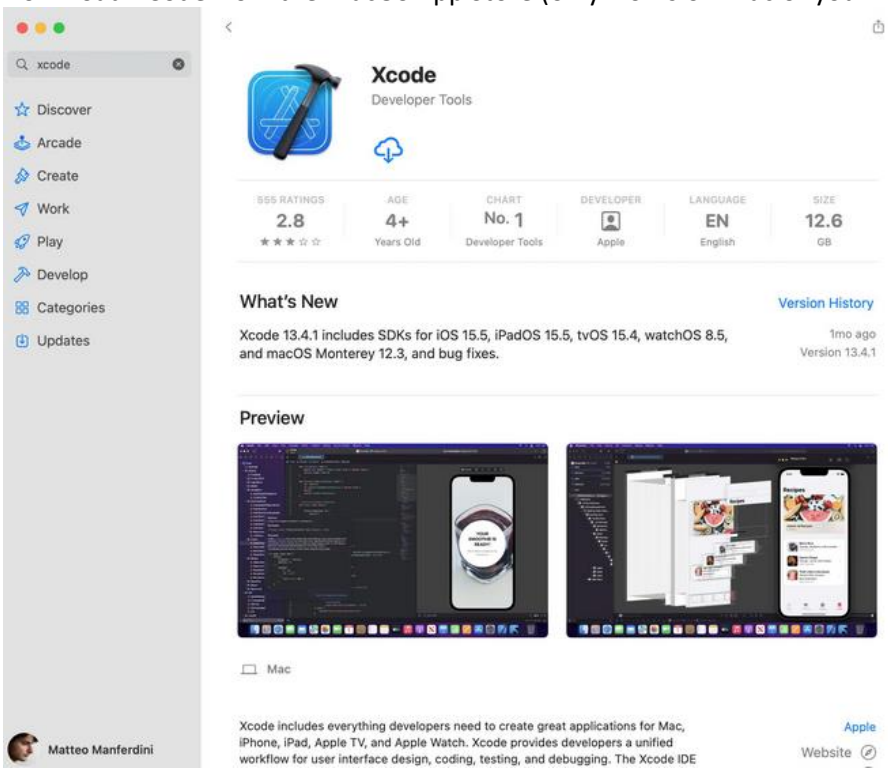
6. Verify that the program is correct by going to Sketch -> Verify/Compile in the Arduino IDE.Test the touch sensor and alarm by touching the sensor with a metal object. The alarm should sound until the sensor is triggered. Here is a picture of the full code.

```
const int touchPin = 2; // the digital pin connected to the touch sensor
const int alarmPin = 3; // the digital pin connected to the alarm

void setup() {
  pinMode(touchPin, INPUT); // set the touch sensor pin as an input
  pinMode(alarmPin, OUTPUT); // set the alarm pin as an output
}

void loop() {
  int touchValue = digitalRead(touchPin); // read the value from the touch sensor
  if (touchValue == HIGH) { // if the touch sensor is triggered
    digitalWrite(alarmPin, HIGH); // turn on the alarm
    delay(1000); // wait for one second
    digitalWrite(alarmPin, LOW); // turn off the alarm
  }
}
```

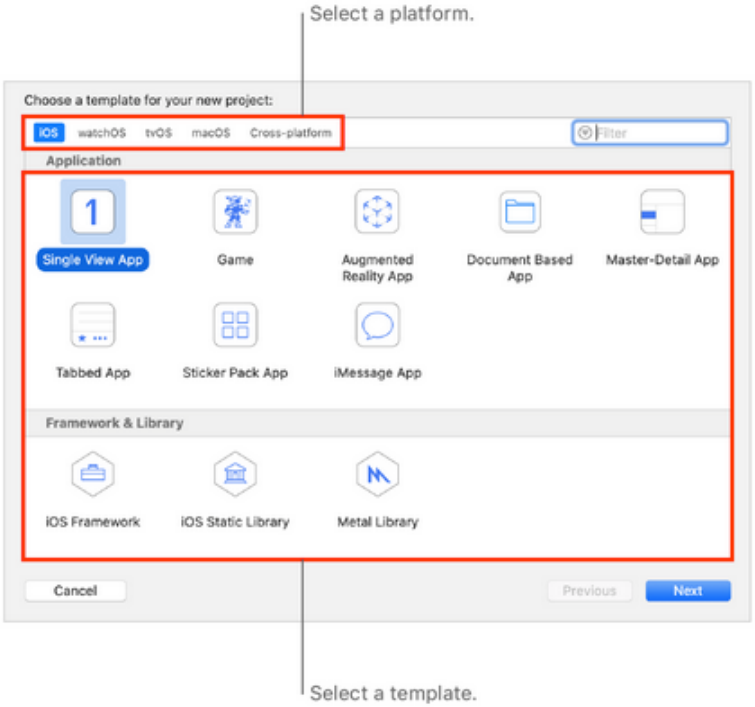
1.

Section 2: Coding and Creating the App

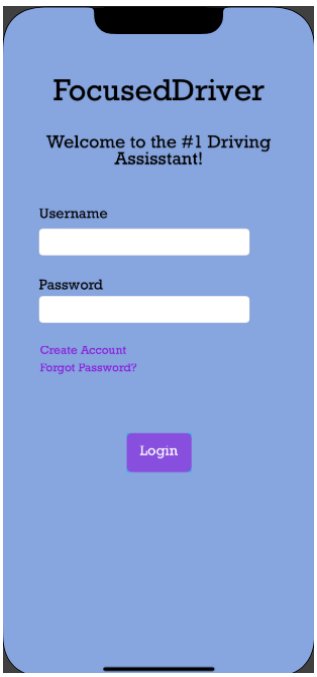
1. Download XCode from the MacOS App Store (only works on Mac or you must buy a virtual machine)



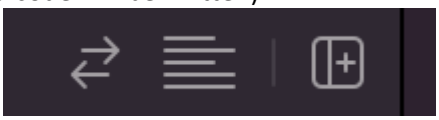
2. Click "Create a new XCode project" and click the App Icon in a view that similar to the one shown below and click "Next"



3. Fill in the information that is asked the software and click "Next" (Make sure the User Interface field has the "Storyboard" option selected)
4. Open the Main.storyboard file
5. Click the "+" button on the top right of the screen and search for the Label, Filled Button, Button, and TextField components. Drag and drop these components to recreate the following screen below:



6. Find the following buttons in the top right of the screen. Click the middle button and select the Assistant option. This should open the ViewController.swift file right next to the storyboard (where all of the backend code will be written)

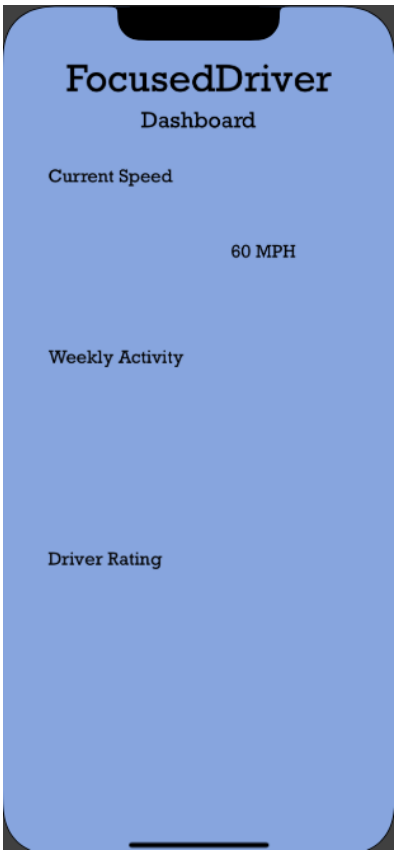


7. Left-Click the button and drag your cursor to the ViewController file screen and create an outlet to the file. Make sure to name your variables a reasonable name. Repeat this process for the other two text fields. Name each respective TextField ‘username’ and ‘password’.
8. Similar to how you added a Label to a storyboard, add a View Controller to the storyboard. Once you have done that, left-click the “Create Account” button and drag the cursor over to the new ViewController. You will now have the option to create a Segue. Give your segue an appropriate name and create the segue.
9. Create a new Swift file. You can do this by going to File >> New >> File >> Choose Swift File and press OK. Name this file “AccountCreation”
10. Link “AccountCreation” to the new ViewController. Click the Identity Inspector and icon and choose the proper fields for linking to be successful.
11. Copy and paste the following code into the “AccountCreation” file.

```swift
import UIKit

class ViewController: UIViewController {

    @IBOutlet var username: UITextField!
    let defaults = UserDefaults.standard
    @IBOutlet var password: UITextField!
    var usernameS = ""
    override func viewDidLoad() {
        super.viewDidLoad()
        // Do any additional setup after loading the view.
    }

    override func prepare(for segue: UIStoryboardSegue, sender: Any?) {

            if segue.destination is LadningPage {
                let vc = segue.destination as? LadningPage
                vc?.header = username.text!
            }


    }

    @IBAction func unwindToRed(unwindSegue: UIStoryboardSegue) {

    }

    @IBAction func lButtonPressed(_ sender: UIButton!) {
        if password.text == defaults.dictionary(forKey: username.text!)?["Password"] as? String && username.text == defaults.dictionary(forKey: username.text!)?
            usernameS = username.text!
            performSegue(withIdentifier: "Landing", sender: nil)
        }
        else {
            let alert = UIAlertController(title: "Oh No!", message: "Incorrect Username or Password", preferredStyle: .alert)
            alert.addAction(UIAlertAction(title: "Try Again", style: .cancel, handler: nil))
            self.present(alert, animated: true)
        }
    }

}
```

12. Add another ViewController and create another SwiftFile named “Dashboard”. Link these two files together using the steps mentioned above.

13. Recreate the following screen below using components mentioned above. To add a picture, add the picture to the assets folder in the builder, and drag a UIImageView component onto the ViewController.



14. Now it's time to implement the Bluetooth portion of the application. Start by importing CoreBluetooth framework into the project.
15. Create a new Swift file named "BluetoothManager.swift"
16. Copy the following code into the file.

```
import CoreBluetooth

class BluetoothManager: NSObject, CBCentralManagerDelegate, CBPeripheralManagerDelegate {
        var centralManager: CBCentralManager?
        var peripheralManager: CBPeripheralManager?
        var peripheral: CBPeripheral?
}
```

17. In the original ViewController, add the following code to your viewDidLoad method.

```
let bluetoothManager = BluetoothManager()
bluetoothManager.centralManager = CBCentralManager(delegate: bluetoothManager, queue: nil)
```

18. Set up the central manager delegate methods to scan for and connect to nearby peripherals.

```
func centralManagerDidUpdateState(_ central: CBCentralManager) {
        if central.state == .poweredOn {
        central.scanForPeripherals(withServices: nil, options: nil)
        }
}

func centralManager(_ central: CBCentralManager, didDiscover peripheral: CBPeripheral,
advertisementData: [String : Any], rssi RSSI: NSNumber) {
        if peripheral.name == "MyPeripheral" {
```

```
            central.stopScan()
            self.peripheral = peripheral
            central.connect(peripheral, options: nil)
            }
}

func centralManager(_ central: CBCentralManager, didConnect peripheral: CBPeripheral) {
            peripheral.delegate = self
            peripheral.discoverServices(nil)
}
```

19. Set up the peripheral manager delegate methods to advertise your app and connect and accept nearby connections by inserting the following code:

```
func peripheralManagerDidUpdateState(_ peripheral: CBPeripheralManager) {
            if peripheral.state == .poweredOn {
            let serviceUUID = CBUUID(string: "MyServiceUUID")
            let service = CBMutableService(type: serviceUUID, primary: true)
            let characteristicUUID = CBUUID(string: "MyCharacteristicUUID")
            let characteristic = CBMutableCharacteristic(type: characteristicUUID, properties: [.read, .write],
value: nil, permissions: [.readable, .writeable])
            service.characteristics = [characteristic]
            peripheral.add(service)
            peripheral.startAdvertising([CBAdvertisementDataLocalNameKey: "MyPeripheral",
CBAdvertisementDataServiceUUIDsKey: [serviceUUID]])
            }
}

func peripheralManager(_ peripheral: CBPeripheralManager, didReceiveWrite requests: [CBATTRequest]) {
            for request in requests {
            if request.characteristic.uuid == CBUUID(string: "MyCharacteristicUUID") {
            // Handle incoming data here
            }
            }
}
```

20. Data can now be transferred via Bluetooth. Go to the settings app and connect to the ArduinoBluetooth module.

21. Now we must collect the actual driving data using the CoreMotion framework. Import CoreMotion into your project.

22. Create an instance of the 'CMMotionManager' class.

```
let motionManager = CMMotionManager()
```

23. Add the following code to the file.

```
if motionManager.isAccelerometerAvailable {
   // Accelerometer is available
} else {
   // Accelerometer is not available
}
motionManager.accelerometerUpdateInterval = 0.1 // Update interval in seconds
```

```
motionManager.startAccelerometerUpdates(to: .main) { (data, error) in
    if let accelerometerData = data {
        let speed = sqrt(pow(accelerometerData.acceleration.x, 2) + pow(accelerometerData.acceleration.y, 2)
+ pow(accelerometerData.acceleration.z, 2))
        // Use the speed value here
    }
}
```

1. Using the speed variable that was populated using the motionManager, we can send this data to the Arduino microcontroller mentioned above and will be able to run through its own code and achieve the intended result

Testing Documentation/Results

PROJECT PARAMETERS

Project Parameter	Explanation
Accuracy	Whether the driver's hands are on the steering wheel or not must be accurately detected by the system. Any false alarms or detection failures could alert the driver and perhaps increase distraction.
Reliability	Long-term dependability of the prototype are requirements for our prototype. The system shouldn't need to be checked on frequently and should be able to tolerate different environmental conditions outside the car.
User-Friendly	The technology should be simple to operate and shouldn't cause the driver any additional distractions. The LED should light up but not excessively bright.
Affordability	To be affordable for all drivers, the system should be offered. According to the consumer surveys that we conducted; the price should be around 50 dollars
Portability	For drivers to use our prototype regardless of the vehicle they are driving, it must be transportable and simple to shift between cars.

TEST CASE REPORT 1

GENERAL INFORMATION			
Test Date:	03/29/2023	**Tester:**	Hand detection sensor
Test Case Description:	This subsystem is responsible for accurately detecting when the driver's hands are off the wheel.		
INTRODUCTION			
Requirement(s) to be tested:	The sensor must be able to detect whether the driver's hands are on or off the wheel with high accuracy and reliability, regardless of hand position or grip strength.		
Roles and Responsibilities:	The testing team will need both of us - one to drive the vehicle and one to monitor the sensor readings. The driver will simulate different driving scenarios, such as turning, braking, and accelerating, while the tester records the sensor readings. We both worked together to create this subsystem as Jai wired the hardware, while Vamsi coded the system needed for the subsystem to function.		
Set Up Procedures:	The hand detection sensor will be mounted on the steering wheel and connected to a data collection system that records the sensor readings. Jai and Vamsi will then run the tests.		
TEST			
Expected Results of Case:	The expected result is that the sensor accurately detects the presence or absence of the driver's hands in all scenarios tested.		
ACTUAL RESULTS			
Output Specifications:	The output that is being observed is the console on the IDE after the driver contacts the touch sensors. It should print words to the console once this condition is achieved. The touch sensors were unable to register the contact made by the driver on the steering wheel. No output was printed to the console after the driver made contact with the touch sensors. Output only occurring when a witness is making sure that there is a firm connection between the sensor and the microcontroller. We will need to find a better way to wire the components to ensure that the components are firmly connected.		
Results:	☐Pass ☐Fail	**Percentage Passed:**	10/**50 = 20%**

TEST CASE REPORT 2

GENERAL INFORMATION			
Test Date:	04/10/2023	**Tester:**	Alarm (LED) system
Test Case Description:	This subsystem sounds an alarm when the driver's hands are off the wheel.		
INTRODUCTION			
Requirement(s) to be tested:	The alarm system must light an LED when the driver's hands are off the wheel for more than a certain amount of time. The LED must be bright enough to be seen over the road and other distractions.		
Roles and Responsibilities:	The testing team will have both Jai and Vamsi - one to drive the vehicle and one to monitor the LED system. The driver(Jai) will simulate different scenarios where the		

	hands are off the wheel, and the tester(Vamsi) will monitor the LED for proper functioning.		
Set Up Procedures:	The LED system will be connected to the hand detection sensor and powered on. We will then mount the prototype in a vehicle and run the tests.		
TEST			
Expected Results of Case:	The expected result is that the LED turns on when the driver's hands are off the wheel for more than the specified amount of time.		
ACTUAL RESULTS			
Output Specifications:	The outputs being observed in this test are the LEDs that should light up after the driver makes contact with the sensors. These outputs were successfully achieved while the tests were being conducted. The LEDs were properly lighting up after the driver made contact with the sensors (located behind the wheel). However, there were a few tests where the LEDs did not light up, but this problem was quickly resolved after we made sure all the wires were connected firmly to each component.		
Results:	☐Pass ☐Fail	**Percentage Passed:**	40/**50 = 80%**

TEST CASE REPORT 3

GENERAL INFORMATION			
Test Date:	04/12/2023	**Tester:**	Power Source System
Test Case Description:	This subsystem provides power to the prototype and ensures that power remains connected throughout the drive.		
INTRODUCTION			
Requirement(s) to be tested:	The power source must provide enough power to the prototype to ensure proper functioning of all subsystems for an extended period of time.		
Roles and Responsibilities:	Jai and Vamsi will monitor the voltage and current provided by the power source and record anything wrong in the power output.		
Set Up Procedures:	The power source will be connected to the prototype, and Jai and Vamsi will monitor the voltage and current readings while the prototype is in use.		
TEST			
Expected Results of Case:	The expected result is that the power source provides sufficient and consistent power to the prototype during all tests.		
ACTUAL RESULTS			
Output Specifications:	The output that is being observed remains the same as the one mentioned in the last test report; however, this time, the main objective is to ensure that the outputs are functioning every single time. Throughout these tests, we continuously altered the wiring of our product as we saw fit, and eventually we were able to achieve a design that passed 96 percent of the time.		
Results:	☐Pass ☐Fail	**Percentage Passed:**	48/**50 = 96%**

TEST CASE REPORT 4

GENERAL INFORMATION			
Test Date:	04/14/2023	**Tester:**	Bluetooth integration
Test Case Description:	This subsystem connects the prototype to a mobile device for additional functionality.		
INTRODUCTION			
Requirement(s) to be tested:	The Bluetooth integration must connect the prototype to a mobile device and enable additional functionality, such as automatic call answering and text message responses.		
Roles and Responsibilities:	Jai and Vamsi will test the Bluetooth connectivity between the prototype and the mobile device and record any connection issues or data transfer failures.		
Set Up Procedures:	The prototype will be paired with a mobile device, and Jai and Vamsi will simulate incoming calls and text messages to test the Bluetooth integration.		
TEST			
Expected Results of Case:	The expected result is that the Bluetooth integration connects the prototype to the mobile device and enables additional functionality as intended.		
ACTUAL RESULTS			
Output Specifications:	The expected output is that the touch sensor is able to send certain data to the mobile application via Bluetooth. Once the touch sensor makes contact with the driver, the application should display a message on the screen confirming that the touch sensor was pressed. However, we were unable to have a successful test during this entire process. More testing and fixes need to be done.		
Results:	☐Pass ☐Fail	**Percentage Passed:**	0/**50 = 0%**

TEST CASE REPORT 5

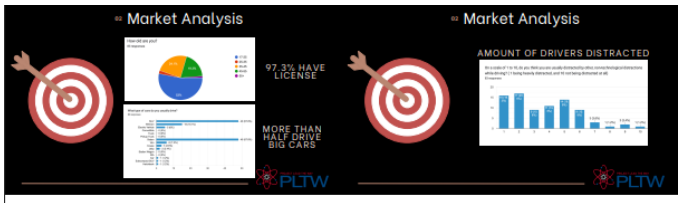
GENERAL INFORMATION			
Test Date:	04/14/23	**Tester:**	Mounting System
Test Case Description:	The Mounting System holds the main prototype all together and ensures that it stays safe		
INTRODUCTION			
Requirement(s) to be tested:	The mounting system must securely mount the prototype in a vehicle without causing any damage or obstruction to the vehicle's existing features.		
Roles and Responsibilities:	Jai will be responsible for testing the mounting system, while Vamsi will be responsible for adjusting the mounting system to fit different steering wheel sizes and shapes.		
Set Up Procedures:	Ensure that the mounting system is properly installed on the prototype and adjust the mounting system to fit the steering wheel of the vehicle.		
TEST			

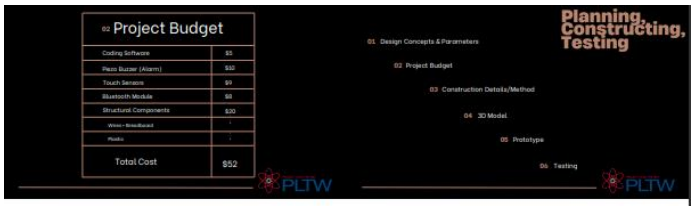
Expected Results of Case:	The prototype should remain securely attached to the mounting system while driving while not moving or shifting during driving. The mounting system should also be able to fit a variety of steering wheel sizes and shapes and shouldnt obstruct the driver's view or interfere with the operation of the vehicle.		
ACTUAL RESULTS			
Output Specifications:	The output that is being observed is that the LEDs remain lit while the user is driving at a safe speed. A witness will record the data to ensure that the driver can be fully concentrated when they are driving. This test was very successful, as the LEDs remain lit up almost every test we conducted, showing proof that our mounting system works exceptionally well.		
Results:	☐Pass ☐Fail	**Percentage Passed:**	45/**50 = 90%**

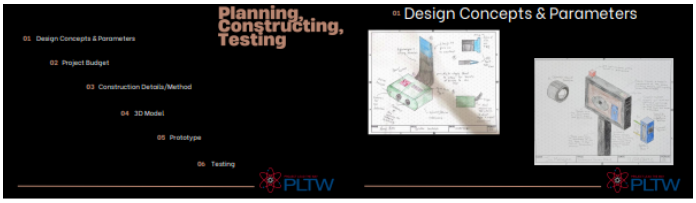
PROJECT RECOMMENDATIONS

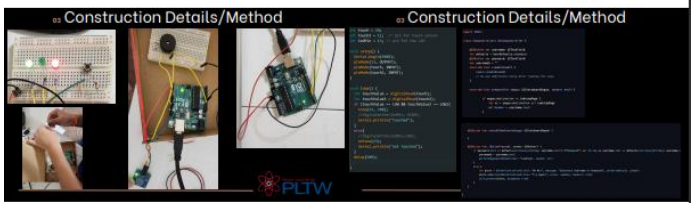
Recommendation	Explanation
Integration with more models and car companies	Our prototype currently only functions with a particular car brand and model. If we had limitless resources, we would invest in expanding our compatibility to operate with additional models, increasing the reliability of our product.
Improved hand detection technology	The hand detecting sensor can be improved even though it is accurate. If we had unlimited finances, we would put them toward research and development to increase the sensor's precision so that it could detect hands even in low-light conditions.
Enhance User Interface	Our current prototype's user interface is provided through a mobile device. To make it simpler for users to engage with the prototype, we might create a touchscreen display.
Alternative Power Sources	Even if our current power supply is dependable, we may investigate alternate power sources, such solar or hybrid power, to lessen the impact of our prototype on the environment and boost its sustainability.
Add safety features	Our prototype already has an alarm system, but to further improve road safety, we may incorporate further security features like autonomous emergency braking and lane departure warnings.

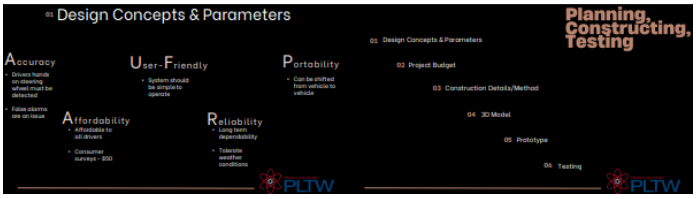
Presentation












06 Testing
Planning, Constructing, Testing
01 Design Concepts & Parameters
02 Project Budget
03 Construction Details/Method
04 3D Model
05 Prototype
06 Testing
PLTW
PLTW


Planning, Constructing, Testing
01 Design Concepts & Parameters
02 Project Budget
03 Construction Details/Method
04 3D Model
05 Prototype
06 Testing
04 3D Model
PLTW
PLTW


Analysis & Conclusion
EFFECTIVE METHOD TO REDUCE DISTRACTIONS
• Able to accurately detect when the driver removes his hand off the wheel
• Consistently relaying data from microcontroller to the phone
Analysis & Conclusion
PROJECT RECCOMENDATIONS
• Improve wiring to allow device to work on sharp turns
• Make app Android compatible
• Implement the driving grade function
• Improve design for components
• Finish application with all features
PLTW
PLTW


Planning, Constructing, Testing
01 Design Concepts & Parameters
02 Project Budget
03 Construction Details/Method
04 3D Model
05 Prototype
06 Testing
05 Prototype
PLTW
PLTW


Analysis & Conclusion
EFFECTIVE METHOD TO REDUCE DISTRACTIONS
• Able to accurately detect when the driver removes his hand off the wheel
• Consistently relaying data from microcontroller to the phone
Analysis & Conclusion
PROJECT RECCOMENDATIONS
• Improve wiring to allow device to work on sharp turns
• Make app Android compatible
• Implement the driving grade function
• Improve design for components
• Finish application with all features
PLTW
PLTW


Thank You!
Mrs. Altman - Teacher
Mr. Kannapah - Expert
Mr. Boyles - Mentor
Paul Bolton - RS Americas Inc.
Mrs. Panidepu - Expert
WE COULDN'T HAVE DONE IT WITHOUT THEM!
PLTW
DISTRACTED DRIVING
PLTW

Reflection

As a team, we are very proud of the design and build process of our prototype. We were able to come up with a product that meets the needs of our target audience while staying within our budget. The testing phase allowed us to identify areas for improvement and make necessary adjustments to ensure the functionality and safety of our product. Throughout the process, we learned the importance of effective communication, collaboration, and attention to detail. We also gained valuable skills in problem-solving and time management. While there were challenges along the way, we feel that we were able to overcome them and produce a high-quality prototype. We would like to give a special thanks to our mentor Jared Boyles and our teacher Jamie Altman for helping us generate ideas and providing us with the resources necessary to be successful in this project. We are excited to continue improving and iterating on our design as we move forward.