DISTRACTED DRIVING

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Interaction Design Studies 2

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CONTENTS

PROJECT BRIEF

Increased cell phone use has had a negative effect on driving habits of almost everyone, especially younger drivers who are still new to the activity.

These younger drivers, generally do not drive the newest car with the latest technology. Even more importantly, they do not have the modern phone integrations to move their interactions with the phone, to interacting with the car instead. Based on my research of this user base, I arrived at my solution of a Heads up Display product.

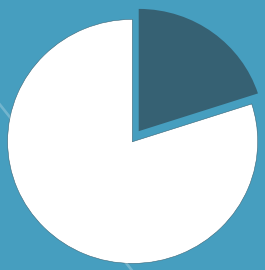
This capstone will see the design and development of a Heads Up Display (HUD) aimed at young adults (16-24 years old), and helping them focus on the road, not their phone, while driving.

The goal of the HUD will be to limit phone use and in turn distractions, while the user is driving. Phone content will be limited to the HUD, as well as most interactions, keeping the user focused forward on the road.

Certain content availability will change depending on the driving scenario the user is experiencing (stop start traffic versus highway driving etc.).

This final HUD will be focused on older vehicles where technology is not as prevalent or integrated.

RESEARCH SUMMARY



80% of accidents are caused by distracted driving

Distraction accounted for **60% of severe teen accidents**

2X More likely to be **killed by a distracted driver** than a drunk

Texting while driving requires **more (and different) brain activity** than other interactions

> Everyone has a story to tell about getting away with it, the **idea of getting caught doesn't really sway anybody**
>
> - Test Subject 1

The most distracting thing while driving (from 62 drivers surveyed) was **cell-phones.**

Most common cell-phone uses while driving were: **texting, GPS, and music**

From the users interviewed, **only 2 indicated** a fear of getting caught.

OBJECTIVES

This project completion will see the limit of phone use while driving through the use of a Heads up Display (HUD). Completed, the HUD will adapt phone interactions (texting, picking music, using the GPS etc.) the screen, controlling phone use and keeping drivers oriented forwards.

The control available to the driver through the HUD should be limited to avoid creating more of a distraction with the HUD, but not appear as such. This will keep drivers from feeling the need to use their phone.

This project will see success quantified through a few different statistics. First of which is cutting down of time on phone while driving. Currently users spend about three and half minutes on a one hour trip using their phone. Using app monitoring data, a reduction of 50% (to around one minute and a half) I feel is achievable for this product in a successful scenario.

Secondly, retention rates for the product will be a deciding factor in it's success. Should users purchase the product and use it regularly, they must see some benefit in it's use, and it must aid their interactions in some way.

The third primary success criteria will be sales of the final product. If users decide a purchase of the product is of benefit to them,

Currently however, the public views distracted driving as an error of the driver, something that simply can be eradicated by not using it. With cell-phone use at its current rates, some interaction is unavoidable. Despite this, the majority of the solutions currently available hamper or deny phone use while driving to discourage any distractions.

The public's perception on distracted driving will need to change for the project to succeed. If it can be accepted that some distractions are unavoidable while driving, then the project will have the highest potential for success.

Should the product be working seamlessly, phone use will be forgotten until the user moves to exit the vehicle. The user at no point should feel as though they are missing pertinent information. This feeling of disconnection will result in distracted driving.

RISK MANAGEMENT

Event	Consequence	Probability	Mitigation	Impact	Contingency
Lack of proper materials	Progress/ Testing will be slowed	Medium	Determine any materials needed ASAP, order any not readily available immediately	High	Change project deliverable. Focus more on interface, demonstrated on simple screen
Learning bluetooth device data transfer/ control	Phone may need to be hardwired	High	Read/research literature on bluetooth connected devices. Attempt to learn through tutorials	Low	Research bluetooth libraries needed earlier and identify feasibility of wireless solution
Causing distraction	Could potentially be considered illegal	Low	Re-evaluate current laws in place for distracted driving. Potentially contact a lawyer/ law officer for opinions	High	Maintain constant feedback from user testers to avoid issue. Consider lawyer suggestions

Event	Consequence	Probability	Mitigation	Impact	Contingency
Lack of skills required to build interface	Poor interface layout	Low	Mockup and get feedback of multiple interfaces. Test as many as possible in final constructed piece context	High	Complete skill testing UI design challenges. Get critique on styling and apply
Learning how to project interface	Poorly functioning final prototype	Medium	Conduct research/ contact hardware developers familiar with creating such physical tech	High	Consider alternative methods to screen projection (alternate mounted screen, phone docking)
Speed to make prototypes	Lack of iterations and major revisions from feedback	Medium	Test out key components as soon as they are completed. Testing individually often (testing each building stage) to get some feedback	Medium	Construct simpler prototypes, limiting content to more barebones, lower fidelity iterations

USER DEFINITION

This project will be focused on drivers aged 16 - 24 located in southern Ontario, mainly those who do not have access to newer vehicles with their updated technology. Income will be limited due to their age, most likely around $20,000 to $40,000 a year. Focus will not be on any particular genders or ethnic backgrounds.

The final device should be accessible to all varying driving skill levels, however it will mainly oriented towards those which are comfortable in their own driving, or at least comfortable enough that they may being to start using their devices while driving.

User's will see benefit in a product like this to avoid tickets, and to "upgrade" their car's technology to something more modern.

These users will want to be more savings oriented, won't have a large budget for expensive purchases (more than likely students or recent graduates) unless it benefits them in some way.

Driving is not a hobby to these users, they will see it as a necessary means to get from point A to point B. These users are more interested in what the most recent piece of car related tech is versus any particular sports car brand's newest release.

PERSONA

Name: Tori Fima
Age: 19
Location: Yonge & Eglinton, Toronto, Ontario
Income: $25,000

Tori is a eighteen year old student currently living at home in Toronto. She is currently attending York University for a BA in Accounting, while simultaneously managing a part time job while working at Moda Night Club across the street.

Due to her circumstances of a lot of late nights, public transit was not a feasible option for Tori, so instead she bought a used 2002 Honda Civic. This in turn also cut down her commute time to school, and is saving her quite a bit on rent / food costs of living closer to the school. However this also leaves Tori with a quite difficult commute. Her route varies quite a bit per day, and never seems to be quite the same. Couple that with her general exhaustion from managing her job and school, and she is left focusing more on her phone in stop and start traffic, then her driving.

Tori knows of the dangers of driving while distracted, but to her it is unavoidable, and simply something she has come to expect.

Should Tori be introduced to our product, she will see value in the ability to see her current GPS route right in front of her. Previously the best she could manage would be a phone mount, which given her other interactions with the device, was not going to cut it. With her phone content being displayed right in front of her, she also has the ability to pre-read any upcoming instructions (including specific street names), as well as her route information so she can keep her group members and other class members informed should she be meeting peers outside of class.

Tori will also see potential in having her phone feed orientated in front of her, off of her phone when stuck in traffic. In driving instances when she would be most likely to whip out her phone, she can instead view and reply to messages within the HUD.

Given specifics of her context, Tori will be seeking a constant display of her phone's content, where it may be quickly referenced without any confusion. She will also look to see benefits of changing her interactions with her phone, both legally and mentally, in her driving.

FUNCTIONALITY

The Heads up Display (HUD) will function as a primary outlet for screen content. Much in the same way Android Auto, or Apple Carplay limits content on screen to simple widgets when connected to an appropriate vehicle, the HUD will constrain content from the phone to the bare necessities.

To do this, users will require an app which controls the HUD display when connected over bluetooth. This app allows for all interactions and modifications to take place from the user side, and will limit phone functionality when on a trip. No notifications or material will appear on the phone screen when connected to the HUD. Instead any of the typical interactions will be fed to the HUD instead. This includes but is not limited to:

- Music player Information/Control
- GPS overview/control
- All text messaging apps (whatsapp, SMS, messenger etc.) reading and writing

Users will interact with content using either provided wireless buttons, or using voice. For the Music Player, skipping, pausing, and playing a song can be controlled directly with the switch, while more in depth commands for picking a song are limited to voice commands to keep the user from getting too distracted.

The GPS will function much like it currently does on the phone. The location will be set prior to leaving, or can be adjusted using voice to text/location recognition from conversations. Instead of being overloaded with information however, the content will be limited to simply displaying the next turn, it's distance, and the actual name of the street to avoid any confusion.

Finally the messaging feed. This component is still being fleshed out in what context it will be available (stop and start, or just all the time), and to how it may be displayed in certain scenarios (full text readable or read out to you). What has been determined is the method of replying. As there are still issues in regards to speech to text services, the product will simply send an audio byte which can be listened to or if the driver prefers, can use speech to text anyway.

PROJECT SCHEDULE

Project Proposal

Research

January

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Breakdown

Project Proposal

- Amalgamation of data (data gathering summary)
- Writing individual entry requirements
- Construction of persona
- Scheduling breakdown
- Identifying next steps for research phase

Research

Consult Research plan on page

PROJECT SCHEDULE

Research

Code Trial Testing

Prototyping

User Testing

February

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28			

Breakdown

Research

Consult research plan on page

Code Trial Testing

- Testing potential libraries applicable to the project
- Coding using these libraries
- User testing/ garnering outside feedback on completed materials
- Physical prototype testing of libraries

Prototyping Phase 1

- Modeling of basic shape and size
- Construction of physical model of the HUD
- Testing of basic interactions between phone and HUD

User Testing Phase 1

- Gather feedback on potential models
- Get feedback on phone interactions
- Consolidate data into reference report

PROJECT SCHEDULE

Prototyping

User Testing

Final Prototype Construction

March

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Breakdown

User Testing Phase 1
- Gather feedback on potential models
- Get feedback on phone interactions
- Consolidate data into reference report

Prototyping Phase 2
- Iterating final model layout
- Physical construction of differing concepts
- Initial concepts of UI interface of HUD and application

User Testing Phase 2
- Gather feedback on final models
- Testing models with volunteer drivers
- Gather feedback on current UI of HUD & application
- Consolidate data into reference report

Prototyping Phase 3
- Iterating final UI of HUD and app layouts
- Iterate button design model
- Return to any components that need more work before final phase

User Testing Phase 3
- Gather feedback on final UI for app and HUD
- Gather feedback on button design
- Consolidate data into reference report

Final Prototype Construction
- Creation of final HUD model
- Design of final UI of HUD and App
- Creation of final button model
- Creation of digital display for final installation

PROJECT SCHEDULE

Final Prototype Construction

Project Refinement/
Final User Testing

Project Completion

April

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Breakdown

Final Prototype Construction
- Creation of final HUD model
- Design of final UI of HUD and App
- Creation of final button model
- Creation of digital display for final installation

Project Completion
- Final presentation of the work
- Submitting of all material

Project Refinement/ Final User Testing

Week 1
- User feedback on full installation
- Multiple user test rounds from users not familiar with project yet
- Compile documentation into full project overview

Week 2
- Complete any changes to full installation
- Continue compiling documentation into full project overview

Week 3
- Minor project changes
- Proofreading of documentation

TECHNOLOGY REQUIREMENTS

The final HUD will require several technological pieces in order to function correctly, each are broken down into major and minor components below.

Button

Front End

Physical Construction

Back End

Bluetooth module (Bluetooth Arduino Javascript Library)
Physical Button Sensor (Button Sensor Library)

Connnectivity

Bluetooth Connectivity (Bluetooth Arduino Javascript Library)
Writing to HUD

HUD

Front End

Screen UI Design

- App Visualizations (HTML/CSS)
- GPS Layout
- Music Layout
- Messenger Layout

Back End

Piece Construction

- Projector (Projector Arduino Javascript Library)
- Display Screen
- Bluetooth Module(s) (Bluetooth Arduino Javascript Library)
- Microphone (Microphone Arduino Javascript Library)
- Arduino

App control (Javascript)

Connectivity

Bluetooth Connectivity (Bluetooth Arduino Javascript Library)

- Receiving from phone
- Receiving from button
- Writing to phone

TECHNOLOGY REQUIREMENTS

App

Front End

Phone Application Interface (HTML/CSS)

- HUD Adjustments
  - Themes (HTML/CSS)
  - Layouts
  - Content
  - Preferences
    - Brightness
    - Auto-Dim
- Button (Bluetooth javascript query)
  - = Reset
  - Reconnect
- App Settings
  - Notification Suppression
  - Communication Whitelist

(Contact detection javascript library)

App

Back End

Phone bluetooth communication (Arduino Bluetooth Javascript Library)

- Two-Way communication

App controllers from commands (Application process modifier javascript Library)

App writers to write to HUD (Application reader javascript library)

Connectivity

Bluetooth Connectivity (Arduino Bluetooth Javascript Library)

- Writing to HUD
  - App Information
    - GPS
    - Messenger Information
    - Music Player

Reading from HUD

- App Commands
  - GPS
  - Messenger
  - Music Player

DELIVERABLES

The project will consist of three key components for its success. The phone application, the actual HUD, and the mountable button.

The phone application is imperative to the HUD display, as well as limiting the phone content itself. The app will relay all important notifications to the user through the HUD, keeping with the project's goal of changing the method of adapting the phone interactions. The phone will still run (in the background) all tasks of communication, mapping, and music. However the screen will be off, instead limiting the content that is available to the user strictly to the HUD.

The HUD is the obvious main component in this project. Through the project, the HUD will eventually be the hub of all primary phone interactions in the car. This will keep the user facing forward in the event they may need to use something like a messenger app. With this the objective of refocusing driver to the road ahead can be achieved.

Finally the button is the smallest component, but also plays a big part. The button works in conjunction with the HUD to control the phones specific applications by providing a physical touch point which the users may decide is most convenient for them to mount. This adaptation of the phone's interactions, again fits with my objectives for this project.

RESEARCH PLAN

Week 1 (January 31 - February 6)

- Project Components Research
    - Identification of feasibility & methods regarding deliverables including:
        - Infotainment Construction
        - Prototyping speed
- Project Interest Research
    - Conduct Primary Research into feedback of user group
    - Identify any glaring issues/pain points from feedback
- Research common vehicles for my age demographic (new and old)

Week 2 (January 31 - February 6)

- Projects Component Research
    - Identification of feasibility & methods regarding deliverables including:
        - Test possible libraries
        - App Functionality/Design
        - Bluetooth Button Creation
- Test issues identified in Primary research
    - Conclude any changes that need to be made to the deliverables, and start them

Week 3 (February 7 - February 13)

- Project testing procedure trial
    - Attempt multiple testing techniques with users
    - Identify tool(s) that returns greatest feedback
    - Make modifications to timeline based off of chosen testing procedure

Week 4 (February 14 - February 21)

- Complete any remaining project component research
- Attempt dry runs of testing procedure using any completed project pieces
    - Receive general feedback on opinion of choices