1 Introduction

1.1 ACKNOWLEDGEMENT

ETG - Provided Gitlab Space and website.

1.2 PROBLEM AND PROJECT STATEMENT

The problem we are trying to solve is teenagers using their phones while driving. We are trying to limit teenager's access to their phones while driving a car so they can be less distracted and more focused on driving and thus reducing the risk of car accidents. The approach we decided to take is designing a system that will block all notifications from a teenager's phone while driving a car. We will achieve our goal by creating a system that consists of three parts; car device, driver's application (app), and parent's application. 1) The device in the car will read the car gear and send a signal to the driver's and parent's apps. 2) The driver's app will block all notifications from the driver's phone and will not allow that phone to be used while the car is driving with the exception of navigation and music. 3) The Parent's app will check if the driver's app is in use and if the car device is functioning. By making all these components work together we will make driving safer for teenagers and will reduce the number of accidents related to phone use while driving. This project will also help parents be more comfortable with their new teenage drivers driving and will reduce their worry and stress.

(Shihab)

1.3 OPERATIONAL ENVIRONMENT

The environment presents challenges for hardware and design of the On Board Diagnostics (OBD) unit. Since the OBD stays in the car at all times, we have to consider the car's internal temperature throughout the year. Our device has to perform when exposed to -20° and 110° Fahrenheit. Also, the unit should endure vehicle activity. We expect it to withstand speed bumps, hard acceleration/braking, reasonable car accidents. Finally, our product has a size constraint. The OBD plugs into the Engine Control Unit (ECU). If the OBD interferes with the driver's operations, we are putting the passengers at risk. This means the OBD can't be very big.

1.4 REQUIREMENTS

SW Functional Requirement:

1. All user types shall be able to login to their account.
2. App shall enter driving mode after signal is received from the OBD sensor indicating car is started.
    a. App shall enter driving mode a set amount of time after signal is received to allow the driver to warm up the car during winter.
    b. Driving mode
        i. In driving mode, the app shall record each time the app is exited.
        ii. The app shall send a real-time notification to the Parent to notify them unexpected behavior has occurred.
3. App shall exit driving mode after signal is received from the OBD sensor indicating the car is turned off.

4. App shall track the history of child's unexpected behavior(exiting app while driving)

SW Non-Functional Requirement:

1. App shall display information clearly with decent color contrast and emphasis on important information.

HW Functional Requirement:

1. The OBD sensor shall connect to the driver's app within a certain range.
2. The OBD sensor shall detect the status of the car: Car in use/Car not in use
3. The OBD sensor shall detect the connection status of itself.
    a. The OBD sensor shall record each time it is unplugged from the car.
    b. The OBD sensor shall send the information of unplugging to the parent's app within a certain range.
4. The OBD sensor shall react to parent's app's ping within a certain range.

(Shuang) done

1.5 INTENDED USERS AND USES

– To properly design an end product that will provide the maximum satisfaction and perform in the most efficient manner, it is essential to understand the end user and the associated end uses.

Our client approached us for this project with the intentions of her daughter using it while she is driving. Her daughter is 15 years old and is just beginning to drive. Our client also has an older daughter who got in a car accident while she was texting and driving. She is hoping that the device we create will be able to prevent her younger daughter from following in her sibling's footsteps and not be in a car accident. If we are able to create a product which works well with our client's daughter, she is hoping to then sell this product to other parents wanting their teenagers to be safer and more responsible drivers. The issue with teenagers using their phone while driving is a growing issue and our client recognizes there are limited options out there for parents to keep their kids safe while driving. Because of this, we will be designing our product to be used by teenagers only, with no intentions for it to be used by adults.

(Chad)

1.6 ASSUMPTIONS AND LIMITATIONS

Assumptions

- That cars were manufactured after 1996 - we will use the OBD port for our hardware bluetooth device
- That the parents are going to check if the bluetooth device is still plugged into the OBD port of the car.
- That the microcontroller will allow us to communicate with the cars main computer
- That the user is well versed with technology - the user should be able to know how to download and install Android or iOS applications
- That the user has a smartphone that will allow him/her to download the application and also access to bluetooth

Limitations

- The cost to produce the end product shall not exceed $150 - that way it makes it cheaper in case it ever goes into mass production

- The end product shall be no larger than; length 5”, width 4” and height 1” - this is because it has to fit in the car’s drivers compartment without causing discomfort while driving
- The user’s phone must be within a few feet for the bluetooth device to connect - if a user is out of range, the phone will not connect to the bluetooth device which in turn does not activate the application

(Issac)

1.7 EXPECTED END PRODUCT AND DELIVERABLES

Our deliverables consist of two products. The first is an On-Board Diagnostics (OBD) unit. The OBD plugs into the car’s Engine Control Unit (ECU) and detects if the engine is started, gear status, vehicle speed, etc. This information will be transmitted to the driver’s phone via Bluetooth.

The second of our deliverables is an app. The app has two account types, “child” and “parent”. The driver signs into the “child” account, and the app receives the OBD data. Using this data, the app determines phone privileges. These privileges include GPS and phone audio like music, phone calls, and navigation assistance. If there’s an attempt to violate privileges, the “parent” account is notified. There are exceptions for emergency protocols where the “child” is given full access to their phone.

A short document similar to an instruction manual will be included. It will instruct the user where to plug in the OBD, how to connect the OBD to the phone, and how to navigate through the app. The first prototype will be released in May 2020, and the final in December 2020.

2. Specifications and Analysis

2.1 PROPOSED APPROACH

From our team discussion, we decided that there are two possible approaches to solve the problem described in section 1.2 of the report. The first approach is to design a phone-case. This case will have a mechanism that allows either the phone or the car key inside at a time, so the driver will only be able to access the car key if the phone is secured inside the case and vise-versa. After almost three weeks of brainstorming and discussing this approach, and on the basis that teenagers might want to listen to music, use navigation, and be in an emergency situation, we decided to abandon this approach.

The second approach the team decided to adopt and implement was the approach discussed in section 1.2 of the report, which is designing a system to block notifications and apps from the teen driver's phone while driving. After agreeing to this approach, we started researching ideas to implement the system. We are now in the research phase of the project. We are trying to understand the different elements of the system and a way to connect them together to achieve our goal. Due to the many requirements of this approach (see 1.4) we decided to divide the tasks and assign each member a specific task to research. In the coming weeks, we will start with the next phase in which we will start purchasing the required elements and pair them together.

(Shihab)

2.2 DESIGN ANALYSIS

We have spent most of our time brainstorming, researching, and designing our product thus far. Initially, our product was supposed to be a case which would deposit your car keys when you put your phone in it. We came up with many issues with this idea however, for example: How would you unlock your cars if your keys were in the case? How would you get your keys if you did not have your phone? What if there was an emergency and you needed your phone to call 911 while the car was running? Would the user need to carry this clunky box around with them everywhere they go? We approached the client and informed her of these concerns and asked her if she would be okay with going a different route which included an app that locks your phone instead. She obliged and we got to work brainstorming ways we could implement this. We came up with many ideas but quickly found ways that the teenager could easily work around and still be able to use their phone while the car is running. We then had an idea to implement a feature that would alert the parent if the child has used their phone while driving or if the child has disconnected the device from the car. She thought this was a good idea so this is what we will be going forward with.

Something we are going to potentially modify in the future is what components use bluetooth to communicate and what components will communicate through USB or wiring. We have concerns about bluetooth drawing too much power and draining the battery. The biggest weakness we have right now is a lack of experience working with phone applications, bluetooth, and OBD-II programming. We are all doing research to quickly familiarize ourselves with it however. The biggest strength is that the entire team has a very good idea about what our final product is going to look like and the requirements it needs to meet. Overall, I think our proposed solution is very solid and is way better than the initial phone case idea that we had.

(Chad)

2.3 DEVELOPMENT PROCESS

The development process we chose to follow is the agile development approach. The reason we chose this approach is due to multiple reasons. First, the fact that we are a team of students who usually do not have schedules that align. The agile approach allows flexibility and adaptability that we think will be very beneficial to us. Second, we would like to push out a prototype as soon as possible and the agile approach will allow fast paced development. Third, the agile approach enables frequent efficient face to face communications. This will keep our team in sync and allow us to have the same goals in the back of our minds.

2.4 CONCEPTUAL SKETCH