Android-Powered Head Unit

Practicality Information

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Patrick Jan   Greg Kaminski   Frank Mischin   Justin Rue

Project Overview

Our project is to build and program a navigation/head unit for a car that is developed using the Android mobile operating system. The head unit will be developed using a tablet as well as other hardware to allow it to communicate with the car. It would be wired into the car's 12V outlet to receive power, the car's antenna to use for data signal, the car's stereo for audio signal, and the car's OBDII port for vehicle information. The head unit will be able to receive diagnostic information from the car's OBDII, and project it into an application so that information can be read and viewed easily by the user. This can be used to show problems with the car, as well as performance items such as gas mileage, oil temperature, tire pressure, speed, and tuning information. As well as being able to read information from the car, you can also use this interface to listen to music and use GPS for navigation. The head unit will be developed in a way that will allow it to be removed from the car. This will allow you to use this head unit as a stand-alone tablet, and also provides added security to avoid theft. It also allows for third-party outside analysis of performance data, if desired.

Assignment Responsibilities

Each member of the group researched a different key aspect of the project to gain a better perspective of the finer details. The various parts in this project that were researched are as follows; Bluetooth capabilities, Android platform requirements and limitations, USB and 3.5 mm jack input specifications, and OBDII specifications. Each member was responsible for gathering a resource and explaining some significance or concern in regards to the overall design to the project. We also looked at some alternative devices and designs to open our options and possibilities. By also looking into other solutions, we are able to see a broader picture of what works well with our project design. Each member looked into tutorials and processes that would help to create the application. This involves, but is not limited to, seeing how each component connected to one another in existing applications and the uses of the individual components in devices.

	Jan, Patrick	Kaminski, Greg	Mischin, Frank	Rue, Justin
Percent Effort:	25%	25%	25%	25%

Information Summary

This project revolves around the use of an Android powered device. In order for this project to be successful, we will need to be able to create an application that can be run effectively on the Android platform. Android is a great tool to use because it is open source.

This is beneficial because the android programming community is very large, so plenty of help and resources are available. However, it is limiting in the sense that we have to use a Java programming language, as well as using Eclipse for the IDE and compiler. The Android environment is a good choice because when the application is installed, it only has access to the resources needed to run the application. This makes the environment secure and safe.

In order to work hand-in-hand with the Android OS and UI, we have decided to utilize the On-board Diagnostic (OBD) port present in all modern automobiles. Use of this port provides the primary benefit of a unified standard, which means this functionality can be implemented in any cars manufactured after 1980. Although this technology would be marketed toward newer cars, it does provide the ability for retrofitting older cars, provided this port is used.

Since this application is going to be created for devices with the Android OS, it will have to be designed to fit the framework of the Android User Interface so as to keep the application consistent with the Android theme. The main portion of the application is the content area, which will display all of the readings and data that the OBD sensor will gather from the car and output to the Android device. The application must also contain a main action bar, split action bar and view control with which users will be able to navigate the different views of the app content. For example, these features will be used to allow users to do things like navigate from one reading type to another, display graphical representations of the data, change the application's settings in the menu, etc. The UI is an extremely important aspect of an applications development; an app can be the most functional app on the market, but if it isn't user-friendly and easy to navigate then it won't be successful, so one of the main goals of this design will be to ensure that the app is optimized for both functionality and ease-of-use.

Another important part of this project is the communication from the OBDII to the android device using Bluetooth. Bluetooth signals will need to be sent back and forth from the android device and the OBDII Bluetooth transmitter. Using Bluetooth instead of a serial connection, or USB connection, will allow us to free up ports on the android device which can be used for other activities and functions within the project. The device can only be communicating on one Bluetooth channel at a time. Therefore, it is very important not to allow other communications, such as Bluetooth communication between the android device and a phone, or Bluetooth audio.

Using a USB 2.0 connection allows for a high transfer rate, while using a connection that does not require host device. This allows for a simpler and sleeker design that can be universally used. This port also allows for device charging capabilities, which is perfect for the on-the-go design of the model. This USB 2.0 connectivity will also give developers the ability to troubleshoot and upgrade applications on the tablet without the need for a signal. Also, it is

possible to then develop a way for mechanics to then access the OBDII diagnostics to a similar way that they would with an OBDII scanner.

A big part of this project also involves transmitting audio over the car's speakers from the android powered device. This can be achieved in a few ways, such as over Bluetooth, or by using a 3.5mm audio jack and breaking it out to the car's speakers. Due to the fact that we are using our Bluetooth communication for the OBDII port, using a 3.5mm audio jack will better suit our situation. A benefit to using a 3.5mm jack is that this can be wired to an external amplifier which will allow for higher quality audio playback.

The android tablet is a very important part of this project. A tablet that is small enough to fit into most car dashboards as well as powerful enough to handle our programs needs to be chosen. The tablet that we decided to go with is the Google Nexus 7. It is a 7 inch tablet which should be able to fit into most cars, has 1GB of RAM, and an NVIDIA Tegra 3 quad core processor. This should be enough to handle anything that we decide to run on it. Another benefit of this tablet is that is hard a fairly large hard drive, either 16 or 32 GB so we have a good amount of storage space to play with. This device also supports NFC, as well as most wireless radios which will allow us to use data on the tablet. This device is running android 4.2, or Jelly Bean, which is a very refined version of the OS with a lot of features that will benefit our production.

In addition to the performance-oriented benefits of including the Nexus 7 tablet, the ability for the owner to remove the tablet from the car is provided. This affords the operator the ability to transfer data between the tablet and his/her computer, syncing both media and performance data.

Constraints and Responsibilities

Constraints

This project has very little concern for realistic constraints. Economically, this project can be low budget. There are affordable tablets and android products that would be able to use the application for our project. The project itself would need the android tablet product, but from a consumer standpoint, the consumer would not need to purchase an android powered device if one is already owned. This project is also designed to be used for almost any car make and model. Therefore, this project would not include the purchase of a vehicle. The other components to this project are moderately low in price, so the overall expenses of this project would be low.

The environment will not pose as a huge constraint in this project. This is primarily a software project. The project can be conducted indoors so the weather conditions would not limit us. Our main goals also do not affect the environment.

There are no health and safety constraints in this project because most of the design in the project concerns the software design of the application. The rest is working with connecting the tablet to the rest of the car's sensors. The only concern may be the fact that the UI may be distracting since it is a touch screen application, but that is not different from systems that are already in place in vehicles.

Manufacturing should not show any constraints because there isn't any manufacturing necessary in this process. The only hands-on process with this project is installing the tablet subunit which may pose a constraint because it depends on how difficult the installation is. An easy installation will mean it could be a "Do it yourself" project, but if it is complicated, it may pose some constraints in the form of needing a professional.

The sustainability aspect of the project should not pose a problem. A working application will be determined by the lifespan of the tablet device and the lifespan of the sensors in the car. Ideally, the application would have the lifespan of modern software and applications with regular updates and bug fixes.

Professional and Ethical Responsibilities

Once the application has been developed, the professional responsibilities of this project include taking the necessary steps to get the app on the Google Play Store for widespread distribution. But before it can be distributed, we will have to ensure that we do not infringe upon any patents or existing ideas, as well as protecting our own ideas and progress.

There really aren't many ethical responsibilities for this project. Since it's an Android application that will be sold on Google Play, the main issue is to set a fair and reasonable price for the app so as not to try and rip off the consumers who will be purchasing the application.

Objective Attributes

The tree below shows that our project is safe. It shows that it can be universal and easily interchangeable and will have little effect on the environment. This product will be flexible to market because it is inexpensive to produce and it will appeal to drivers because it is easy to use. It is also easy to distribute and install, all of which make the product appealing and will promote sales. The product will be marketable because it is useful, inexpensive, portable, and lightweight. All these factors show why our project will be effective and appealing.
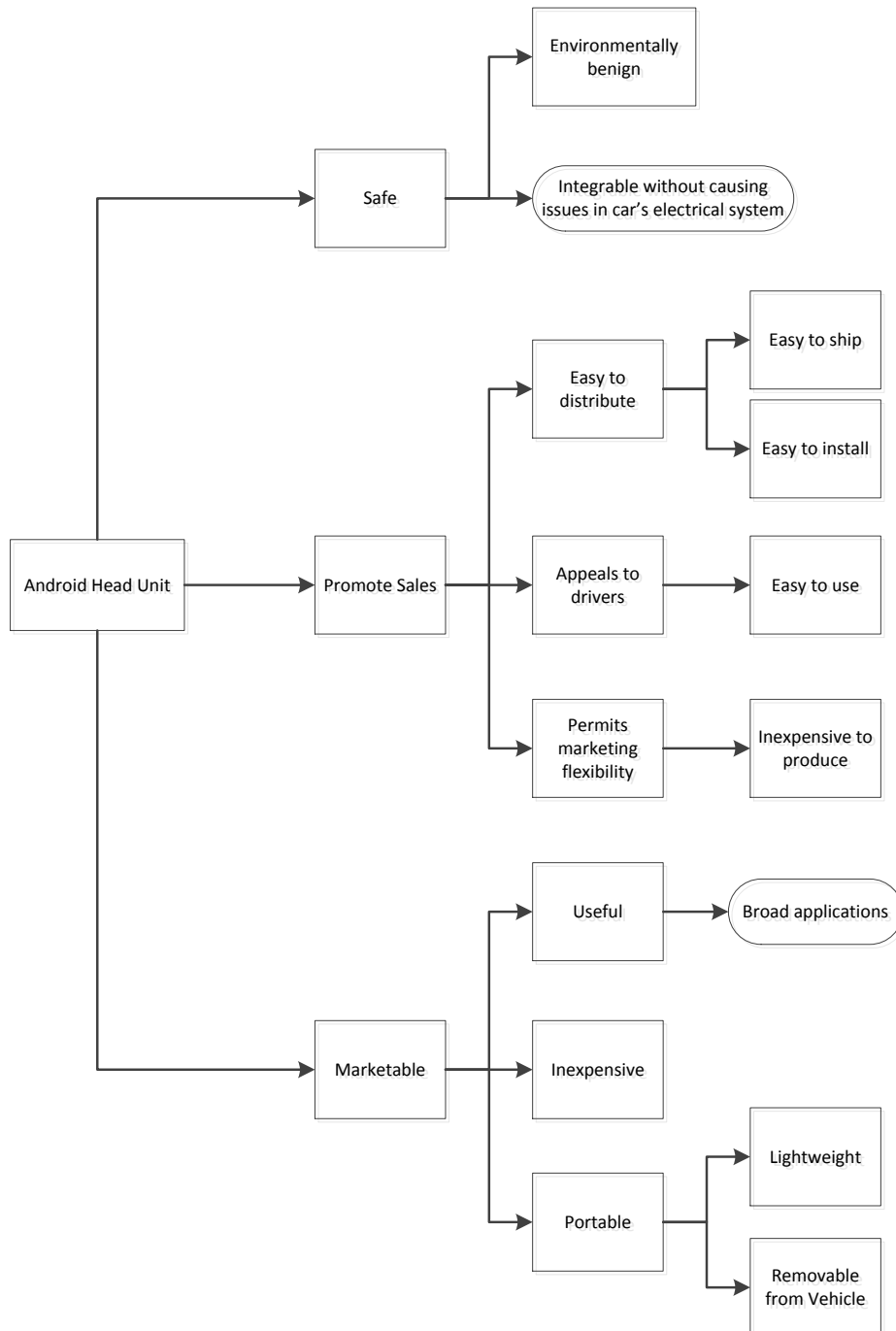
References and Additional Resources

[Bluetooth 4 Specification](#)

[USB 2.0 (High Speed) Specification](#)

[USB 3.0 (Super Speed) Specification](#)

[Android Development Specifications](#)

[Android UI Specifications](#)

[Google Nexus 7 Tablet Specifications](#)

[EPA OBD Outline](#)