Delphi Advanced GPS Connectivity System

E-Design 100 Section 14
Team 2 Pure Life Frogs
Submitted to Wallace Catanach
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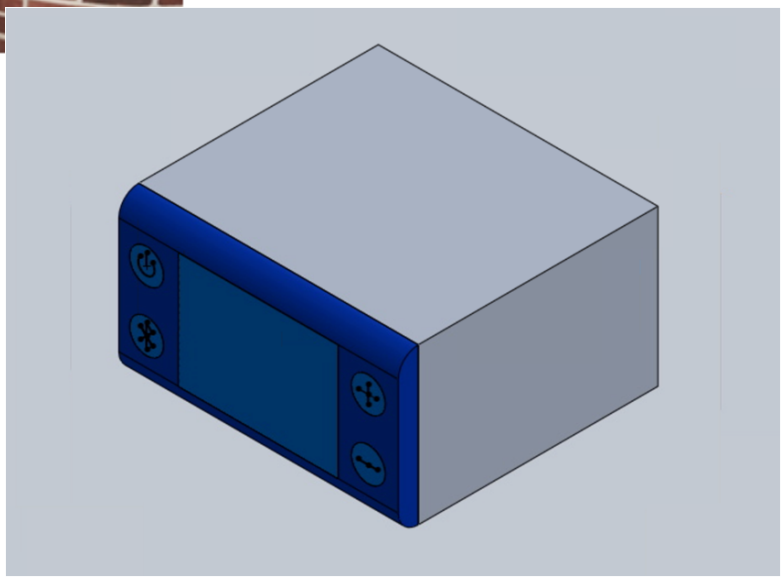

Pure Life Frogs

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Executive Summary

The Delphi automotive corporation has tasked the Pure Life Frogs to create a connected, green, or safe device to be integrated into automobiles. Automobile accidents are a leading cause of injuries and deaths of drivers and passengers. Carbon dioxide emissions, which contribute to global warming, have become a primary concern in the construction of new vehicles. In-car connectivity technology could potentially help to reduce the number of accidents and the amount of carbon dioxide emissions.

In creating the design of this connectivity technology, the Pure Life Frogs considered several concepts. Initial patent and market surveys were conducted. This helped us to determine what features to include in our technology. After defining and ranking the customer needs and target engineering specifications, our concepts will be scored in a matrix. We will be creating technology that includes gps technology, bluetooth integration, audio and visual aids, and location services.

Introduction:

Pure Life Frog Engineering has designed a navigation system that offers a users a driving experience that is more safe, green, and connected. The device will improve the everyday lives of customers by improving efficiency and safety. It also connects to any smartphone, eliminating the need for drivers to look at their smartphone while driving, greatly reducing the chance of an accident. This system can be installed in the place of a radio in any car. Incorporating GPS and Bluetooth technology, the device improves on existing products by combining multiple technologies and creating a new, innovative product that revolutionizes the driving experience.

Mission Statement: To create a product that provides a safer, greener, and more connected driving experience.

Customer Needs Analysis

The device helps to advance transportation
The device helps inform, entertain, connect, and protect their passengers.
The device incorporates in demand features without substantially adding to the vehicles mass or cost
The device helps minimize the environmental footprint of vehicles
The device can alert responders in case of an accident
The device helps the driver avoid traffic
The device makes the driver aware of cops
The device accounts for construction in the user's area
The device can allow friends to see your location
The device marks landmarks and can navigate to them
The device accounts for weather and can alert the driver
The device can bring up an aerial view of tough to navigate locations
The device has both auditory and visual warnings
The device notifies the driver of their driving efficiency
The device connects with the user's cell phone to display and read messages
The device asks who driving to notify receipts the user is driving
The device allows the user to reply to texts or use automated responses
Source:
http://sedtapp.psu.edu/design/design_projects/edsgn100/fa14/EDSGN_100_delphi_FA14.pdf

External Research

Existing Technology

Technology that is currently available includes navigation and Bluetooth however there is no technology such as ours which integrates connected, green, and safety aspects into one device. GPS navigation is one existing technology which is similar to our technology. This technology uses GPS satellites to give drivers directions to their destinations. Our technology advances on this by accounting for traffic, construction, and weather. Not only does this help the driver reach their destination quicker it also allows for less fuel consumption. Fuel economy is also improved with our technology because we have created a system to monitor the driver's driving style and offer feedback for improved fuel economy. Another similar type of technology which is available is Bluetooth which is available with many cars. Although Bluetooth is useful for phone conversations we have created a system that allows the driver to audibly send text messages. This helps create a safer environment on the road and keeps the driver connected with world around them. Police radar has been around for years and helps make the driver aware of police on the road. We have added this technology to our device to make the cop show up on the navigation and ensure the driver minimizes violations.

Existing Technology Sources

http://images.amazon.com/http://images.amazon.com/

www.desertshieldpersonalsafety.com

d13z1xw8270sfc.cloudfront.net

Patent Search

Our patent search resulted with 0 patents with designs such as ours, however we would have to obtain rights to use patents for technologies such as police radar, Bluetooth, and navigation.

Benchmarking

We benchmarked our product after similar touchscreen GPS systems available on the current market. Our system adds various features to them and advances on the ones available. Using the dimensions of current GPS touchscreen systems we were able to build our system so that it could be integrated and used in various automotive applications, independent of manufacturer. This system can be installed as an aftermarket system or be built into a new car.

Global Marketplace

This product will be available and sold globally. Because of its design it is able to be integrated into various automobiles to make it as widely available as possible. The need and desire for a system that makes driving more connected, safer, and greener will be very popular on the global marketplace.

Maintenance Requirements

The product will take place of a factory radio in almost any car, thus the largest maintenance requirement will be to have it installed. It is possible for the user themselves to install the product. This will require plug converters for the power and radio plugs as well as running a new antenna for the internet. After proper installation the user will need to connect their phone to the device using Bluetooth. Once all of these steps are taken there should not be any maintenance required if properly maintained. If there is a specific problem it will need to be diagnosed and fixed as needed.

Background Information

· Blue-Tooth- Radio wave connectivity between your cell phone and the devise over a short distance, Cheap and inexpensive way of wirelessly connecting, also uses little battery life

· WiFi- Similar to Blue-Tooth in the sense that it also uses radio waves, however WiFi uses a router to decode the radio waves and send them through a wired Ethernet cord back to the internet. WiFi range is much further than Blue-tooth, however, one consumer must pay for the internet so it is not as cheap.

· 4G- To continue the pattern 4G is again a more advanced version of wifi, in the sense that it is radio signals. This is a larger scale of WiFi, however, and the device connecting to 4G will first need to connect to a base station, similar to a radio tower or a big router. Then theses base stations send the signal to your providers network where it is again connected by hard wire.

· Touch Screen- This device will use a technology called “projected capacitance” also known as p-cap or pro-cap. This is a solid state technology meaning no parts move. It works by using an electrical capacitance build it. When your finger or in this case the electrical charge is near the screen then a buildup of electrons lets the device know where the user is touching. This is usually built with two layers of two layers of conductors separated by an insulator usually glass. This is a good type of touch screen because the user doesn’t actually have to touch the conductive layer thus it is more durable and doesn’t leave the conductor as vulnerable.

· Radio Technology- radio technology is quite simple actually, radio waves are sent from the radio station, then it is often boosted through towers and base stations, and then your car’s antenna picks up the frequency and is sent through your radio.

· Voice activation- it all starts with a microphone in the device. From here it will be connected to a voice recognition system. Most systems use a what they call “language in pieces.” Just like sentences are broken down into words that are broken down into letters that are broken down into syllables, the same is down when listening to people speaking. The software often has a pattern recognition system as well. It can be changed from language to language and detects common patterns in the users speech.

Examination of Manufacturing Process

The manufacturing process will be very similar to radio and cell phone manufacturing. The manufacturer will purchase many of its raw parts from suppliers, while the more complex and project specific parts will be made in house. Most of the manufacturing will be done by robots and overseen by workers. The basic parts in the product will consist of a circuit board, antenna, resistors, capacitors, amplifier, microprocessor and microphone. This is just a short list of parts, all encased inside an aluminum housing on all sides, except the front or faceplate which will be made up of plastic, a touch screen and a few buttons. Quality is always a concern and since many of the parts are from suppliers, there will be random tests on the equipment to ensure quality. Lastly the product will need to be boxed, and shipped

Final Specifications

Width: 7 inch
Depth: 6.5 inches
Height: 3.9 inches
Screen size: 7 inch
Weight: 5lbs
Internet: 4G
Radio: Sirius/standard
Bluetooth
Voice activated

Driving Survey

These 8 questions were asked to 50 people.	% said yes
Have you ever been in a car accident?	56%
Would you be willing to pay more for a car that greatly reduces the chance of an accident?	96%
Do you own a smartphone?	98%
Would you like your smartphone to be more connected with your car?	92%
Do you feel that carbon emissions from cars will have a lasting effect on the environment?	100%
Would you be willing to pay more for technology that would get you to places faster?	94%
Do you feel that weather is a big factor in driving efficiency?	96%
Do you feel that the presence of construction sites affect driving efficiency?	90%

Concept Generation

Customer Needs Importance

#		Need	Imp.
1	The device	Helps to advance transportation	3
2	The device	Helps inform, entertain, and protect the passengers	3
3	The device	Incorporates in demand features	3
4	The device	Helps minimize the environmental footprint of vehicles	2
5	The device	Can alert responders in case of an accident	3
6	The device	Helps the driver avoid traffic	2
7	The device	Makes the driver aware of cops	1
8	The device	Accounts for construction in the users area	1
9	The device	Can allow friends to see your location	1
10	The device	Marks landmarks and can navigate to them	1
11	The device	Accounts for weather and can alert the driver	2
12	The device	Can bring up an aerial view of locations	2
13	The device	Has both auditory and visual warnings	3
14	The device	Notifies the driver of their driving efficiency	3
15	The device	Connects with the users cell phone to display and read messages	3
16	The device	Asks who is driving to notify recipients	3
17	The device	Allows the user to reply to texts or use automated responses	3

In this table we ranked the customers needs based on how important we felt they were to our customer. Using the importance rankings we determined which features would be most important to incorporate into our product. After analyzing our customers need we determined that having in demand features such as apps, a first responder alert, auditory and visual warnings, cell phone integration, navigation, and driving efficiency were the most important features to include.

Product Specs Metrics-Matrix

Metric	Total Mass	Total Cost	MPG Improvement	Storage Capacity	Dimensions	Screen Brightness	Audible Volume	Internet Connectivity	Car Compatibality	Cell Phone Compatibility	Years of continuous use	Navigation Technology	Police Radar Scanner	Indemand Features(Apps, Social Media)	Driver Safety (Reduce Distraction)	Location Features
Need																
Advances Transportation			X					X	X	X		X				
Helps Inform, entertain, conect and protect passengers								X		X		X				
Incorporates indemand features			X					X				X		X		
Mimizes enviromental footprint			X									X				
Incorporates saefty features								X		X					X	
Helps the driver reach a destination quickly												X				
Reduces the chance of getting a ticket													X			
Shares location with others								X		X						X
Connects the driver with local landmarks								X				X				
Connects the driver with weather								X								
Makes navigating easier												X				X
Efficiently alerts the driver							X	X							X	
Connects the user with technology								X		X				X		
Keeps the user safe while driving						X	X			X					X	
Allows the driver to communicate safely						X	X	X		X				X		
Does not add to vehicle mass	X				X											
Does not add to vehicle price		X														

Our product spec metrics matrix helped us line up our customer needs with the features we would be including on our device. Giving a unit to each need helped us determine what features would be included with our advanced GPS. Based off of our metrics-matrix chart we determined that MPG improvement, internet connectivity, cell phone compatibility, and navigation technology would be among the most important features on our device.

Concept Selection
Selection Matrix

Need	Blue Tooth	Wifi	4G	Touch Screen	Radio Technology	Voice Activation	Remote Control
Advances Transportation	0	plus	plus	plus	plus	plus	0
Helps inform, entertain, connect, and protect passengers	0	0	plus	Plus	plus	plus	0
Has indemand features	0	plus	plus	plus	0	plus	0
Minimizes environmental footprint	0	0	0	0	0	0	0
Safety features	plus	0	0	minus	0	plus	minus
Helps driver reach destination quickly	minus	0	0	0	0	plus	0
reduces chances of getting a ticket	plus	0	0	minus	0	plus	minus
shares location with others	0	0	0	0	0	0	minus
connects driverwith local landmarks	0	minus	plus	0	plus	0	minus
connects driver with weather	0	minus	plus	0	plus	0	minus
makes navigating easier	0	plus	plus	0	plus	plus	minus
efficiently alerts the driver	0	0	0	0	0	0	minus
connects the user with technology	0	0	0	plus	0	0	plus
keeps the user safe while driving	plus	plus	plus	minus	plus	plus	minus
allows for safe communication	plus	0	0	0	0	plus	minus
Does not add to vehicle mass	0	0	0	0	0	0	0
does not add to vehicle price	0	0	0	0	0	0	0
Sum +	4	4	7	4	6	9	1
sum 0	12	11	10	10	11	8	7
sum -	1	2	0	3	0	0	9
Net score	3	2	7	1	6	9	-8
rank	4	6	2	5	3	1	7
continue?	yes	no	yes	yes	yes	yes	no

In order to narrow down our ideas and see which ideas would actually work well with our product, we used this concept selection matrix, which compares our ideas, or concepts, with our needs. Initially, we thought about incorporating the use of Bluetooth, Wi-Fi, 4G, touch screen, radio technology, voice activation, and a remote control in our design. Then, we put them into the concept selection matrix to see if they met the needs, which are shown in the leftmost column of the matrix. If the concept did not meet the need or had a negative effect on the need, it would be assigned a minus for that need. If the concept barely met the need, or did not stand out with respect to the other concepts, it would be assigned a zero. Lastly, if the concept met the need very well and stood out, it would be assigned a plus. After comparing our concepts to our needs to our concepts, we added up the total pluses and minuses to get a total score for each concept, then we ranked the concept from

one to seven based on their total scores. Then, using this information, we decided which concepts to continue and which ones to discard. In the end, we decided to continue all of the concepts, except for the Wi-Fi and remote control, because they failed to have a positive impact on our product.

Target Specifications

The device will have:

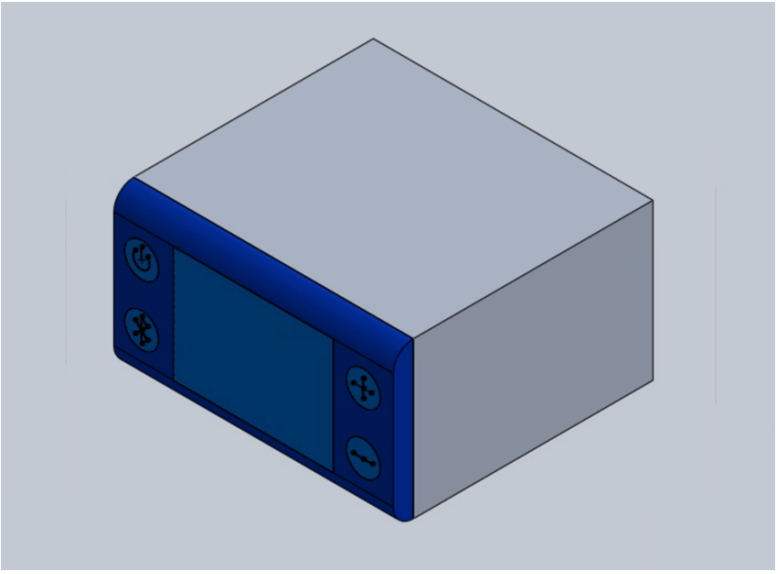
- A light mass
- An affordable price
- A feature to help improve the gas mileage of the vehicle
- A high storage capacity with expandable memory
- Compact dimensions to take the place of the cars radio
- An option to adjust the brightness of the screen
- An option to control the volume of the device
- Internet connectivity
- The ability to be installed in new and old cars
- Cell phone connectivity and compatibility
- A long lasting life for all features
- Improved navigation technology
- A police radar feature
- In demand features such as apps, social media, and text messaging capability
- Driver safety features to reduce the drivers distraction
- Location features to make friends aware of the passengers location
- Location reporting services to notify responders during an emergency

Cost Model

	Per unit	Per year (10 million units)
Cost of production	$65.50	$655 million
Revenue	$119.00	$1.19 billion
Profit	$53.50	$535 million

At a price of $119.00 per unit and production cost of $65.50 per unit, and an estimated 10 million units sold in the first year of production, the estimated total profit is $535 million.

Final Design Description



The final design of the system features an aluminum housing on all sides. The front of the device, the side that is exposed when the device is installed, is made of plastic and contains a touch screen with buttons for power, bluetooth, and volume control.

Conclusions

During the course of this project our team collaborated to design a navigation system that created a driving experience that was more safe, connected, and green. We researched existing technology, including GPS, Wifi, Bluetooth, radio, and voice activation. We also conducted surveys to determine which features we wanted to incorporate into the product. We created a Solidworks model that showed the device with its touchscreen and buttons. The system is able to connect to the user's smartphone and offer hands free driving. It can also display apps, text messages, and phone calls from the smartphone. It informs the driver of more efficient routes to travel. The device can also alert authorities in the event of an accident so that help can arrive as quickly as possible. We created a product metrics matrix and concept selection matrix in order to narrow down the features included in the final design. This project helped us become better acquainted with the 8-step engineering process.

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