

Team 9 - Design Issues Paper

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TEAM MEMBERS

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Safety issue

Since the project started, safety was always a main concern. In the vehicle video recording and monitoring system, safety issues are not obvious, but they still exist. Acknowledging these unobvious problems could be very meaningful. Any potential problem could be deadly, especially in a vehicle with speed of 100Mile/hour. During the design stage, many safety issues were already issued and reduced to the minimum possibility. We classify these problems into two phases, physical issues and psychology.

Physical issues

The main Physical issue of the system is fire. Almost all electrical machines have the potential fire issue, but in small areas, fires could be very fatal. According to the National Fire Protection Association, "In 2003-2007, U.S. fire departments responded to an average of 287,000 vehicle fires per year. These fires caused an average of 480 civilian deaths, 1,525 civilian injuries, and \$1.3 billion in direct property damage annually." To avoiding this deadly issue, the team chose a small power input supply. The total power should be lower than 30W. According to the test we have, the lower power can significantly reduce the heat that machines generate. In other words, lower power can reduce the potential possibility of fire. To further improve the design, the team can use flame-resisting materials to contain the whole system. The team strongly believes these actions will reduce the fire possibility to the minimum.

Another potential problem is car crashes. In the event of a car accident, the system could fly out. Considering the very high speed, the flying part could be very deadly, especially if the system contains metal part. To solve this problem, the team came up with two steps. First, the team will try to avoid using metal in the whole design. However, this does not mean non-metal flying parts are not deadly. Team will choose a very firm box to contain the whole design.

Psychology

One of the main requirements of this project was to add a display screen so that the driver can view if the system is working properly. However, another

safety issue comes with this requirement - distraction. It could be very dangerous, because the driver could potentially get distracted and end up in a deadly situation.

The solution we provide has 3 parts:

1. Team uses small screen and try to filter out all useless information. When tester wants to focus on the driving, he will not see the screen. When he wants to see the screen, he can easily to read everything he need in a few seconds.
2. Buttons. Team builds several buttons to start/stop recording, etc. in order to simplify the operating step. Tester only needs to push a button instead of using a keyboard to type a specific command. All of this can be done with one hand. This setting will significantly reduce the potential issue which cause by distraction.
3. The team decided to have the whole system work automatically. If necessary, system can set up into auto-mode; it will reduce the possibility of distractions.

Safety issues are never small, so the team always gave them the highest priority.

Environment Issues

For the navigation monitor system, this system that compose with the Ordroid-XU which is considered as a mini computer, 7inch HDMI screen, four cameras, and one power source with the step-down converter. Also lots of 14 gauge wire was included. All these parts can evolve into an environment problem.

The copper wires can be recycled after a lifetime of use; the copper can be remade into another areas. The insulator as reclaimed rubber is difficult to recycle and it will cost lots of money to do that, which is not efficient. Rubber can damage the environment and cause air pollution. After all, we can classify environment problem into two parts, product issue and recycle issue.

Producing issue

Whole system use many plastic material, this material can be very damage to the local environment. However, metal and wood are also out of question, because metal may cause potential safety issue, and wood is also damage to the environment.

To solve this problem cannot depends on the technology only, also needs to involve the management problem. First of all, team will try to choose harmless plastic material as much as possible. Second, a monitor system must be built, in the further product procedures, all the potential pollution must be monitored and report to the government. Factory has obligation to reduce the pollution into a reasonable level.

Recycle issue

System uses many noble (precious) metals such as copper or silver as the wires. In the electrical part, there also have many materials which may cause serious environment problem if users abandon it without any environment-harmless processing. Those metals could be recycled and other material could damage to the environment.

According to above, team strongly suggests that Bosch could build a recycle system focus not only on our production, but on everything they produced. Collecting abandoned productions and recycling is a new way to expand their business. It may not very financial efficiency, but it absolutely will earn huge reputation from this action.

Project Lifestyle Management (PLM)

In industry, Project lifecycle Management (PLM) is the process of managing entire life circle from design, production, distribution, maintenance and retirement. By doing PLM, it will reduce the time and the waste to market. The quality and the reliability of the product will be improved.

Design

This system developed at Bosch's Automobile department is aimed to record videos during the driving test without disturbing driver's attention. It is not a simple machine any more, but a system that combines the video recorder, computer processor, and a data store, which can support hot plug and play. The goal of this system is to provide a safely and reliable error recording system to test drivers, ensure all entertainment and navigation functions operate successfully, and further improve the system. The system must properly works in variable situations, like short travel in snow day or crossing multiple states. It also has to record all the errors about software bugs or misuse of the user.

Our product has large potential to upgrade in the future. Customer can add more cameras to record different area. Also, customer can change to big screen, even touch screen. The cost of our product can range from \$800-\$1000. The cost will be more when costumer needs better quality camera. The product is charged by the car cigarette lighter. It has good energy efficiency since it doesn't need extra battery.

Production

In manufacturing process, the cost will decrease to \$600-\$700. Our product is assembled by small part so that it is very safe to manufacturing and cost a small mount of energy. The material should be plastic since our product should be light. The production time is less than 5 hours for each product. Our product won't need to be produced a lot since it is only used for test navigation system. It also won't have scrap by-product and toxic by-product.

Distribution

The package box of our product should be 5inch depth, 10inch long and 8inch wide. The size is smaller than a shoes box. It will be easy to ship to our costumer. The transportation is around \$20 and the time is about 2-3 days. In

order to fit in different car, our product will only be made by order since different car company may costume it. The sales network should be online order only.

Consumption

The product is just like a tablet computer with four cameras and four buttons. It is not necessary to train our customer since it is user-friendly. We will create a demo on YouTube to show how to use it. It also does not need maintenance. The product will come with a one year warranty. If the product does not work, we will give our costumer a new one. Customers are not allowed to upgrade the system by themselves. They need to give the product back to us and let us upgrade.

Retirement

The useful lifetime is around three years. If the product works well, the costumer can trade-in the old product with us and get the newest version of the product any time. The customer support is lifetime. The old screen, CPU and camera can be reused in some low level machine. The wire and the plastic will be recycled.

Standards

In order to meet the specification of the customers and satisfy the requirements of the sponsor, a series of standards are necessary to be applied in the process of designing an electronic product. Although standards can generally be divided into several types, the most important one that is frequently referred to examination of products is the mandatory standards. In our project, the standards can be specified in terms of hardware and software:

Regarding the hardware components, the first standard team has to be care about is the readability of street signs. Since project is required that customers as test driver is be able to collect captured video and identify the street sign during driving test, quality of captured video becomes a very important

factor to determine whether customers is able see contents of street sign clearly or not. Therefore, the selection of camera is a necessary step to meet standards of customers, and team has come up with the Logitech C310 Webcam as a high resolution webcam to capture street signs. The resolution and frame rate are fairly high at 720p and 30fps with Logitech C310, which has satisfied requirement of sponsors that can capture details of numbers or characters on a distant street sign. In addition, the webcam has auto-adjusting abilities that will be able to adjust settings such as aperture, ISO, shutter speed, and focusing to produce great video quality.

The second standard with respect to hardware component is the power supply to Odriod chip. As the odriod chip plays important role in functions of infotainment and navigation monitor system, it is crucial to consider significance on power supply of odriod chip. If the whole system cannot be power on, the failure of turning on device may result in complaints and disappointments on the final products. The specification of Odriod chip requires 5V/4A DC input and the plug need the inner diameter 2.1mm and outer diameter 5.5mm. So the team has researched a series of power converters and finally decided to use Drok SR waterproof DC buck converter. The input voltage can be taken from 12V and output voltage is 5V, and it also has 5A as current output with 25W power, which completely reached the standard required from odriod chip and functions well in result of testing. Moreover, one of advantage to choose this converter is that it can be directly connected to Cigarette Lighter in the car, and it is very user-friendly to power on whole system during driving a car.

As for software component, the third standard can be represented as edit of streams, which is required to splitting up the video into four steams and combine them into one video files so that they can merge concurrently . Our solution is to use FFMPEG to achieve the feature of combination of streams by defining four different types of filters. By configure the output of video file, the FFMPEG allows user to tile four different video streams inputs into one 480p video. In addition, it will also allow users to edit video on the fly via terminal to select which video as input source and which video as output file.

The last standard in regards with the software component is the playability of video codecs. Since the format of video files generated by FFMPEG are mostly MKV files, the correct format of media player is necessary to choose in order to play the output video files successfully. After some testing on playing video, most of popular media player such as quick times or window media player does not support the format of MKV well. However, team come up with VLC media player, which has satisfied the format of MKV files, and it is completely compatible with any types of output video files generated by FFMPEG. Nevertheless, the quality of video played by VLC media player is much better and clear than popular media players and no bugs found during playing with MKV files.