

Design Issues

ECE 480: Design Team 6

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Introduction

During the design of our product we have identified several design issues which need to be addressed. These issues include ensuring the safety of individuals who use our product, how we will effectively transition from the design to the distribution of our product, and how we can properly protect our intellectual property. By addressing these issues during the design phase we are able to produce a higher quality and more useful product for our intended customer.

Project Lifecycle

This product's lifecycle has a unique perspective of making a device that is user friendly for those that are visually impaired. In designing this type of product we have to take account numerous of variables that determine the functionality and longevity of our product. Instead of focusing on the short-term improvements of our product, we must take into consideration the Product Life Management Principles (PLM). This will ensure that we are able to create an efficient product that will be accountable for its entire lifespan within a company. Generally, product life management develops along through the following stages:

- Design
- Production
- Distribution
- Consumption
- Retirement

Design

Throughout our design process it has been an important factor for our group to design a product that is similar to products already available in the market. However, the products currently available are simply too expensive for an average student. An important goal for our project is to make our product more affordable. Some of the existing Braille machines can range from \$800 to \$7,000 or even higher. Most Braille machines are large

and heavy, often weighing 25 pounds or more. Ultimately, our group wants to make a device that exceeds our consumer expectations and performs efficiently to avoid customer complaints or concerns. One of the most compelling design features in our product with regards to the PLM is the familiar Braille texture to blind-users and making the device lighter to become portable. Our group knows that this product will be necessary, because without it, students are forced to use expensive resources that are not always portable. We know that our design isn't the first of its kind but we are sure that our product will be an affordable alternative for an average student.

Production

The production phase of this product should be similar to most Braille machines on the market. However, our group tried to keep manufacturing cost to a minimum due to a pre-set budget of \$500. This budget is drastically lower than what a standard device on the market most likely used.

Before we could begin with the production of the device, we had to analyze the prior team's final results of the device they constructed during Phase I. We concluded that the previous phase of the project had a few design issues that we had to deal with. The first design issue involved the pins vibrating continuously while the device was being used. Another design issue was the low resolution of the device which made discerning images or text difficult for blind individuals. We needed to design prototypes to handle and solve these issues.

With time management and a fast paced work ethic we were able to design three prototypes within our production time. The first two prototypes dealt with attempting to resolve the vibrating pins issue. They were semi-successful, but the circuits needed some work. The final prototype successfully demonstrated that we were able to eliminate the vibration of pins. After the construction of the final prototype the design was ready for full-scale implementation.

To ensure quality control, each device will undergo an electrical testing to make sure the machine displays Braille characters sufficiently. There aren't many environmental issues with this product. If the machine outlives its usefulness the device can most likely be recycled or disposed properly.

Distribution

Our primary market is geared toward people who are visually impaired. In the US, there are approximately 1.3 million blind individuals, so there are plenty of people to justify mass production of our device. The distribution of our product is most likely to be done through traditional retail supply chains or specialty stores. There are Braille companies that sell their products online, so we could utilize these somehow. Perhaps we could sell our products to those companies, or form partnerships with them. We could negotiate compensation so both parties can be satisfied. Shipping costs will depend on the time frame that the customer wants the product in - whether it would be expedited or regular shipping. More devices would be made according to the demand for product.

Consumption

Production consumption is another major concern for the success of this product. Our product utilizes a personal computer and our Braille machine. The customer has to synchronize these devices together. First, an image is uploaded through the Graphical-User-Interface. Then, the computer communicates to the device to raise pins on the display as the user hovers above the image with the mouse. If the product has an error and somehow fails and our team is not there to fix the problem, the product lifespan will depend on the customer's understanding of the product. Therefore, we will have to create a text version along with a Braille version of a user manual to be included with the product. The manual will be the guide for how to use the device properly and fix or troubleshoot the device should problems arise. If problems still persist, we will have an e-mail that the customers can refer to if they still need assistance.

Retirement

Our goal is that our product will function efficiently throughout multiple generations of visually-impaired students globally. However, with constantly evolving technology and rapidly changing environments, this is unlikely. One of the most evolving features of technology is that of the use of personal computers. Our device currently uses a Graphical-User-Interface design to interact with a standard PC and monitor of today. Perhaps the future involves more tablet machines or some other device not currently on the market. This means we should be constantly working to upgrade and improve our device. As we do work to upgrade the device, we would want to be loyal to our customer base that has purchased prior, outdated devices. We could offer discounted prices to customers who send in their device and then either upgrade the parts or software ourselves, or recycle those parts and send them a brand new product at the discounted price. We know this is possible because for our project this semester we have taken the device that the engineering team from Phase I designed and have either used their parts for our design or upgraded existing parts.

Protection of Intellectual Property

Intellectual property (IP) is any product of the human mind that has commercial value. Under intellectual property law, owners are granted certain exclusive rights to a variety of intangible assets. The U.S. Constitution states: “Congress shall have the Power...to promote the Progress of Science and useful Arts by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.” To encapsulate this quote, the Constitution is sanctioning a monopoly so that inventors will disclose their inventions in full rather than keeping them a secret. The inventor will receive a stipend on the use of the invention for a defined period of time and in return the inventor must fully disclose information on how the invention was created and built, as well as how it can be improved. There are several ways to protect one’s IP. The primary legal mechanisms for protection of IP are patents, copyright, industrial design rights, trademark, trade secret, and trade dress.

For our project intellectual property would pertain to all the software written to interface with the user and control the device, as well as the modeling and creation of our circuitry that drives the pins up and drops them back down. By protecting our intellectual property we would be able to contribute to the “Progress of Science” as mentioned in the U.S. Constitution. Making our technology accessible to others, in order to improve upon, would supplement to the growth of the economy. Economists estimate that two-thirds of the value of large businesses in America can be traced to intangible assets. By patenting our technology and designs, we would be able to help progress the production of devices similar to ours that assist those with visual disabilities. The patents would also secure our intellectual property and prevent it from being stolen others. If our team was a part of a company developing this product, it would be very important to protect our intellectual property. Not only for the sake of securing profits from future customers, but as well as maintaining the production and growth of the company.

Product Safety

Our product incorporates technology which has the potential to create a safety hazard if improperly used. Within our product, there is a power supply, moving magnets, and solenoids wound with unwrapped wire. Each of these items can be hazardous with regards to safety. If a user was to open the casing of the product, or was to break the case open, the exposed components would provide the possibility for a significant electric shock from the power supply and from exposed wire on the solenoids. Additionally, the moving magnets could provide for a possible projectile which could injure the user if the case becomes opened.

We have planned for measures to counteract these possible safety concerns. The first measure that we have planned to take is to provide the product with a very sturdy case that does not easily break. Additionally, instructions will need to be provided to the user regarding proper usage of the equipment in order to ensure that there are no injuries resulting from misuse. We have also removed the danger of having projectiles when the casing is properly intact by designing the product in such a way that the pins are indirectly raised and lowered by the magnets. The design involves the magnets, which

are driven by the solenoids, indirectly raising and lowering the pins by using an attached ramp-like component. A diagram of this design is shown below in Figure 1:

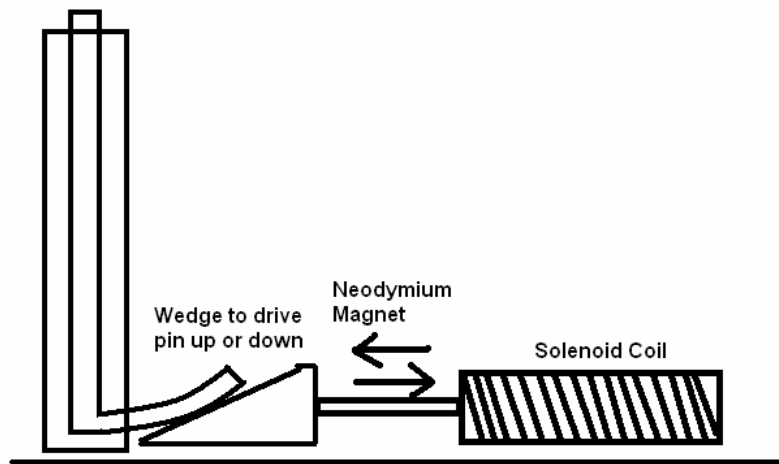


Figure 1

Conclusion

Focusing on specific design issues has enabled us to identify and address concerns during the design process. Through careful analysis and planning we have been able to create a product that is unique, effective, and ready for distribution. We believe the steps we have outlined above will enable us to successfully create a product well-suited for our intended customer that should solve the issues for which we were presented.

References

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