Ethical and Environmental Analysis

Year: \_2019\_\_\_\_\_ Semester: \_\_\_\_Fall\_\_\_\_ Team: \_\_10\_\_\_ Project:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Gesture Controlled Remote for Smart Home\_\_\_\_\_\_\_\_\_\_\_

Creation Date: \_\_\_\_\_\_\_\_\_\_Nov 8, 2019\_\_\_\_\_\_\_\_\_\_\_\_ Last Modified: March 3, 2015

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Assignment Evaluation:

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| --- | --- | --- | --- | --- |
| **Item** | **Score (0-5)** | **Weight** | **Points** | **Notes** |
| **Assignment-Specific Items** | | | | |
| **Environmental Impact** | 2.5 | x6 | 15 |  |
| **Ethical Challenges** | 3 | x6 | 18 |  |
| **Writing-Specific Items** | | | | |
| **Spelling and Grammar** | 3 | x2 | 6 |  |
| **Formatting and Citations** | 3 | x1 | 3 |  |
| **Figures and Graphs** | 5 | x2 | 10 |  |
| **Technical Writing Style** | 3 | x3 | 9 |  |
| **Total Score** | 61 | | |  |

5: Excellent 4: Good 3: Acceptable 2: Poor 1: Very Poor 0: Not attempted

Comments:

*Comments from the grader will be inserted here.*

I would suggest redoing the homework.

1. Environmental Impact Analysis
   * *Outline the environment impact of your product at various stages of its life cycle (manufacture, normal use, disposal/recycling) – e.g., any product using rechargeable batteries represents a potential environmental hazard, any product with a printed circuit board requires hazardous chemicals in its manufacture and is not inherently biodegradable.*
   * *Discuss how you would address each of the environmental impact concerns outlined above (e.g., provide explicit means/process for reducing use of hazardous chemicals in manufacture, extending your product’s useful lifetime, recycling hazardous materials).*

Environmentally, there are five major concerns in our project: the LCD, batteries, printed circuit board, the 3D printed base, and the disposal of the device at its end of life.

First of all, the LCD emits low levels of radiation which could negatively impact human health. In addition to that, the manufacture of LCD monitors requires sulfur hexafluoride, a chemical substance that is believed to be responsible for 29 percent of all global warming. The LCD manufacturing process also releases nitric oxides, hydrochloric acid and hydrofluoric acid, which is responsible for acid rain. Some of the other LCD monitors also use hydro-fluorocarbons, which are known to cause depletion of the ozone layer. [6]

Secondly, [Rechargeable batteries](http://news.discovery.com/rechargeable-batteries/) are greener on the production end since they last for hundreds of cycles over many years. Nevertheless, the materials such as cadmium, cobalt, and leaf are not eco friendly. When rechargeable batteries degrade in landfills, heavy metals can taint the surrounding air, topsoil and groundwater, eventually [getting inside our bodies](http://news.discovery.com/tech/indias-poor-risk-slow-death-recycling-e-waste.html). [7]

Printed circuit boards(PCBs), as an inseparable part of most electronics equipment, have a potential to harm the environment during manufacturing processes. The environmental impacts are resources consumption, wastewater, and damage to human health. There are three ways to recycle PCBs, which are thermal processing, chemical processing, and physical processing. During the processes, waste water, air, and alloy will be produced and caused environmental impacts[1]. However, it is possible to tackle this through the application of waste minimization practices[2].

3D printed base is printed by a spool made with Polylactic acid (PLA). PLA can be more environmental friendly than plastic because it is mostly made from corn starch. However, this will cause an increase in the demand of corn which might cause food shortage since corn is also widely used in fuel and food. Moreover, PLA has a slow process of biodegrade, so it would cause the accumulation of PLA. [3]

As for the concern of disposal of device after its end of life. As the four concerns mentioned above, the device contains heavy metals and chemicals. It harms the environment when sitting in the landfill. Even more, when it is recycled incorrectly and is burned, it will release toxic and harmful materials to air.[4]

1. Ethical Challenges
   * *Outline the ethical challenges your team would have to resolve in the process of bringing your design to market*
   * *Discuss how you would address each of the ethical challenges outlined above. (testing under a variety of operating conditions, placement of warning labels, providing cautions in user documentation, adding safety or anti-tampering mechanisms).*

It is always important to consider any ethics issue that might come up during the development of a product. As for our smart home remote, as long as it is operated in its regular usage and functionality there shouldn’t be any major problems. However, there are a couple potential misuse we still need to take account into the production.

One thing that could cause possible issue is the lithium-ion battery we are using to power the device [5]. Although it is relatively environmentally friendly compared to other types of regular batteries, it still impacts negatively on the environment. It is not a mature enough technology to make the battery fully degeneratable. In our prototype, we will still be using the rechargeable lithium-ion battery because of its affordability and reliability. In the future, it might be better to investigate more environmentally friendly power technologies, such as small solar panels.

Another potential ethical issue would be the size of the electronic components used in the product. If the consumer decides to disassemble the product, or if the product is broken, the small components inside might be of danger to children. We did not thoroughly make sure that all the components are Rohs verified. If a child mistakenly consumes the components it could potentially cause health issues. To minimize this kind of situation, it would be necessary to add a warning message on the manual and a warning label on the packaging of the product. That way any misuse caused from not knowing could be at least controlled to a smaller amount.

The final ethical issue would be the way the users could interact with the product. Since we are using the motion detecting sensor, the user would need to have the ability to provide different gestures close to the front of the device in order to use the product. We realize that many people might not be able to fully use the product because of all kinds of limitations. A possible improvement on the product for future use would be to add more variety in how the user could interact with the device. We could potentially increase the detection range of the device by adding sensors on more sides of the product.

3.0 Sources Cited

*Throughout this and other papers, use of the IEEE citation style should be used. Use of embedded hyperlinks for all web-based sources is required. A reference to the IEEE citation style format is provided* [*here*](http://www.ieee.org/documents/ieeecitationref.pdf)*.*

[1] scientificamerican (07/01/2018) *The Environmental Impact of Corn-Based Plastics* [online]

Available: <https://www.scientificamerican.com/article/environmental-impact-of-corn-based-plastics/>

[2] SpringerLink (10/06/2006) *Printed Circuit Board Recycling Process and its environmental Impact Assessment* [online]

Available: <https://link.springer.com/article/10.1007/s00170-006-0656-6>

[3] ResearchGate (07/2016) *Environmental impacts of a printed circuit board manufacturing plant via streamlined approach* [online]

Available: <https://www.researchgate.net/publication/305659320_Environmental_impacts_of_a_printed_circuit_board_manufacturing_plant_via_streamlined_approach>

[4]PC(04/20/2017). *How to Recycle Your Technology.* Available: <https://www.pcmag.com/article/263140/how-to-recycle-your-technology>

[5] Battery University (2013) *Is Lithium-ion Ideal Battery* [online]

Available: <https://batteryuniversity.com/learn/archive/is_lithium_ion_the_ideal_battery>

[6] NS ENERGY (10/14/2019) *Is the Nobel Prize-Winning Lithium-Ion Battery Really Having a Positive Impact on the Environment?* [online]

Available: https://www.nsenergybusiness.com/features/lithium-ion-battery-environmental-impact/

[7] itstillworks (2019) *Negative Effecs of LCD Monitors* [online]

Available: <https://itstillworks.com/negative-effects-lcd-monitors-7478611.html>

[8]Science on NBCNEWS.com (08/2010)  *Are batteries bad for the environment?* [online]

Available: <http://www.nbcnews.com/id/39214032/ns/technology_and_science-science/t/are-batteries-bad-environment/#.Xby2w5NKgUE>