Ethical and Environmental Analysis

Year: \_2017\_\_\_ Semester: \_Spring\_\_\_ Team: \_\_8\_\_\_ Project:\_\_\_\_\_\_\_\_Barbot\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Assignment Evaluation:

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| --- | --- | --- | --- | --- |
| **Item** | **Score (0-5)** | **Weight** | **Points** | **Notes** |
| **Assignment-Specific Items** | | | | |
| **Environmental Impact** | 5 | x6 | 30 |  |
| **Ethical Challenges** | 4.5 | x6 | 27 |  |
| **Writing-Specific Items** | | | | |
| **Spelling and Grammar** | 4 | x2 | 8 |  |
| **Formatting and Citations** | 5 | x1 | 5 |  |
| **Figures and Graphs** | 5 | x2 | 10 |  |
| **Technical Writing Style** | 4 | x3 | 12 |  |
| **Total Score** | 92 | | |  |

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

Comments:

1.0 Environmental Impact Analysis

Our project is composed of an automatic slider, a stepper motor, a linear actuator, two 4-bottle liquor dispensers and a wood frame. The control module is a PCB board mounted with various capacitor, voltage regulator, resistors, Bluetooth module, and microcontroller. The frame of Barbot is made of wood.

There are a total of three stages for products’ life cycle, which are manufacture, normal use, and disposal/recycling. We will go through every step of products’ lift to discuss the environmental impact.

In the stage of manufacturing, PCB [1] is considered as a key part. The main material is fiberglass with a copper foil bonded on one or both sides. The printed circuit is made from copper coated with tin-lead to prevent oxidation. Some part then will be coated with one more layer of nickel, or gold for better conductivity. Tin-lead [2] and copper as heavy metal will not only damage environment if they contaminate water, but also venerate people who long time contact with those metals or accidentally drink contaminated water. The best way to eliminate those environmental impact is minimizing the size of PCB, which will efficiently reduce the quantity of raw material used to build the PCB.

The 4-bottle liquor dispenser is composed of metal frame, rubber bottle inserts, rubber suction cups, and push release valves. The push release valves are made from polyvinyl chloride. [3] Polyvinyl chloride is known as PVC. During the production of PVC, large use of chlorine gas is used. PVC produces a lot of organochlorine, a chemical thatcauses several environmental hazards.. From the formula of PVC, vinyl is also the major source of dioxin, a global pollutant. To reduce the effect of chlorine and vinyl during production, less push release valves used in the project will reduce the amount of PVC needed. We decided to use 8 bottle liquor dispensers in total, which are the least number of dispensers required.

The manufacturing process of stepper motor will need the Lead to produce four color input wire. During the manufacture process, if Lead is released in the environment, they can make their ways into the air, soil, and water. Lead [4] exists in the environment as dust, which could cause air pollution. Accumulated Lead in the soil will be absorbed by plants. Water contaminated with lead consumed by animals or humanis life threatening. Before Lead can be used as raw material, there is a process of purifying, which is called smelting process. In the process, with the help of sulfur and other chemicals, lead is purified as well as great amount of sulfur dioxide will be released to air . Sulfur dioxide [6] is the major precursor of acid rain. Acid rain [5] can acidify soils, lakes, and streams. Given below showing how sulfur oxide causes acid rain.

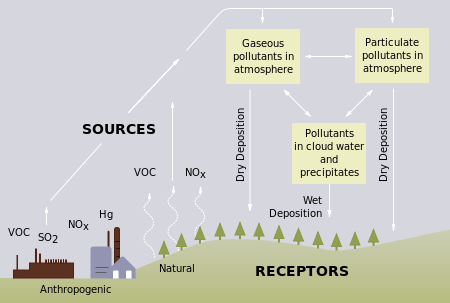


Figure 1: the origins of acid rain.

During the nominal use, there won’t be a lot of environmental effect. Except that, the whole device needs a wall power to supply the required voltage. There are also several replaced glass bottles because of running out of the liquor, but all the glass bottles are recyclable. Some liquor bottles are made from plastic bottles, which are polyethylene terephthalate. Disposal of this kind of bottle will affect the environment.

The issue of disposal and recycling of Barbot is mainly from PCB, 4-bottle dispenser, and the replaced empty bottles from Barbot.

Disposal of PCB involves a lot of environmental effect. PCB [7] is made from several different metal materials. One of those raw materials is called ferric chloride, which needs to be disposed of at a hazardous waste facility rather than throwing them inthe trash can. This chemical is dangerous for both the environment and human body. Recycling of PCB becomes essential to avoid those heavy metal flow into the environment without any treatments. Nowadays, the technologies used for recycling PCB is composed of three branches, thermal processing, chemical processing, and physical processing. The thermal processing is using thermal recovering way to recover the metal out from the PCB. In this process, lots of waste air and industrial dust will be produced, such as dioxin and lead fume. Chemical recovering process needs to put PCB parts into acid to purify and recover metal from PCB. Tons of wastewater is produced. This water is contaminated with waste acid, and various waste metallic ions. The nonmetal materials will be carbonized because of the chemical action with acid. Those carbonized materials can’t be recycled or reused any more. The physical process includes disassembly of PCBs, shredding and smashing of PCBs, and separation of metal and nonmetal powder. During this process, noise pollution is mentionable. Those noises come from the equipment for shredding and smashing PCBs. The noise intensity is about 130 dB. Dust pollution and irritant odor also comes with physical process. All this recycling process is an improvement on just randomly disposing PCBs in the landfill or water. There are also further optimizations in this process by incorporation of sound insulation andtreatment of wastewater before releasing them to water source.

For the process of recycle of the bottle dispenser and stepper motor, they both can be disassembles into smaller metal or nonmetal pieces. Sorted collection for these disassembled parts will be the best to recycling them. Recycling PVC [8] from the dispenser and the polyethylene terephthalate from the replaced liquor bottles have a complex procedure. Instead of throwing those plastic materials in the landfill or water source. Recycling and reuse plastic has further reduced the impact of the white pollution.

1. Ethical Challenges

There are several ethical considers needed to be addressed for Barbot. Ethical considerations is about the overall safety to users during usage. There several minor issues about safety that need to be considered. Those issues include about regular usage, waterproofness, durability of Barbot, and limit usage for underage people.

Regarding regular usage, the first thing to mention is that users shouldn’t shop the Barbot during the process by unplugging from the power source. This will cause unexpected issues. The best way to turn off the Barbot is to wait the Barbot to finish its job and let the platform of the automatic slider return to its original position, then turn off the device by unplugging it from the power source. Users shouldn’t send their order in a long distance in case it is out of the range of the Bluetooth module. Also, users should avoid some barriers, such as walls, while sending the order to Barbot within the range of Bluetooth module. Those barriers will affect the communication between the mobile phone and the Barbot. There will be a remainder placed in the user manual to advice users to use the Barbot properly.

Another issue needed to addressed to Barbot is waterproofness. Barbot will have a container made from water-repellent material to store all the control module of Barbot. The wood frame will be painted a layer of waterproof paint as well. With those protection, users still need to pay attention during the usage. Users need to wipe the device as soon as possible if they saw liquid on the case of control module container to avoid the liquid sink into the control module along the seam crossing. Improper operations will cause undesired safety issues. It’s possible that the control module may catch on fire. There will be a warning sticker on the control module case to tell the user wipe the case if they saw liquid.

The physical attributes of Barbot make it less durable, because of its weight and size. So, users need to pay more attention while they want to relocate barbot. Barbot needs to be transported and handled with care. It’s because all the liquor bottles are made from glass. Users are better to remove the liquor bottle with the dispenser from the shelf before relocating the barbot. There is a trick with the dispenser that user could easily remove the liquor bottle off the shelf. After relocating the Barbot, users need to make sure every part is in the original position. During this process, there won’t be any safety issues related, but users are required to be cautious and patient.

Finally, another ethical concern that the team is considered about, is the overall safety of teenagers when using this product. Barbot’s target consumers are adults over 21 years old. Any teenagers under 21 years old are not allowed to use the product, based on the state law. If there are several non-alcohol drinks available on Barbot. Teenagers can use Barbot when accompanied with parents.

3.0 Sources Cited

[1]“Printed Circuit Board,” *How Products Are Made*. [Online]. Available: http://www.madehow.com/Volume-2/Printed-Circuit-Board.html. [Accessed: 04-Apr-2017].

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[7]SpringerLink (2006, October 6) Printed Circuit Board Recycling Process and Its Environmental Impact Assessment [online] Available: http://link.springer.com/article/10.1007/s00170-006-0656-6#page-6



[8]"PVC-recycling technologies - PVC", *Pvc.org*, 2017. [Online]. Available: http://www.pvc.org/en/p/pvc-recycling-technologies. [Accessed: 04- Apr- 2017].