

Homework 12: Ethical and Environmental Impact Analysis

Team Code Name: Drink Mixer Group No. 2

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Evaluation:

SCORE	DESCRIPTION
10	<i>Excellent – among the best papers submitted for this assignment. Very few corrections needed for version submitted in Final Report.</i>
9	<i>Very good – all requirements aptly met. Minor additions/corrections needed for version submitted in Final Report.</i>
8	<i>Good – all requirements considered and addressed. Several noteworthy additions/corrections needed for version submitted in Final Report.</i>
7	<i>Average – all requirements basically met, but some revisions in content should be made for the version submitted in the Final Report.</i>
6	<i>Marginal – all requirements met at a nominal level. Significant revisions in content should be made for the version submitted in the Final Report.</i>
*	<i>Below the passing threshold – major revisions required to meet report requirements at a nominal level. Revise and resubmit.</i>

* Resubmissions are due within **one week** of the date of return, and will be awarded a score of “6” provided all report requirements have been met at a nominal level.

Comments:

1.0 Introduction

The Drink Mixer is an eight channel audio mixer that is capable of adding effects as well as saving and loading scene settings. In regards to ethical considerations, care must be taken to ensure that the device functions as it is supposed to. Also the user must be warned of any action that could result in injury to themselves or the device. In regards to environmental concerns, the current prototype contains materials that could be harmful to the environment. However, any future devices can be greatly improved upon and as long as the user follows disposal instructions, no harm should be done.

2.0 Ethical Impact Analysis

As with all manufactured products, it would be unethical to release a product that does not function as advertised or causes harm to the user. Once the hardware of the device has proved functional and reliable, testing must be done to ensure that all of the software works as it should. Each channel must be tested with combinations of effects to ensure that all effects can work in any combination. There must also be tests done with all of the channels in use with a variety of effects. There is a chance that there will not be enough memory if certain effects, such as delay, are used on every channel. If such a case exists and cannot be fixed, the user must be warned that the device may not function properly under these cases.

There is a chance that the user may decide to prevent the fader from moving to the location specified by the Hammer. This would result in excess wear to the fader motor and the fader could cease to function. Software has been implemented to prevent this from happening. If the fader motor is unable to move the fader to the specified position after a few seconds, the motor will stop and the Hammer will be notified of the current fader position. There has been mention of user harm if the H bridges were to burn up and turn the entire device into a fiery disaster. This can happen if two PWM channels are actively trying to move the fader in opposite directions. However, software changes have ensured that both PWM channels cannot be turned on at the same time. Thus, the H bridges (and nearby flammable objects, such as the user) will be safe.

If the device were to be damaged by water or some other liquid, various components may short circuit and the entire device could cease to work. There is also a potential that the user could be shocked if this were to happen. The user must be cautioned in the user manual that this device is meant to be used in an indoor environment and should be kept away from liquids. The user could also be shocked if they were to open the device and begin messing around with the components inside. There will be a warning in the user manual and may also be a warning label specifying that the device should not be opened.

The packaging of the device is made from aluminum and may have sharp edges. If these edges cannot be filed down, it is possible that the user could cut themselves on the sharp edges. There will be a warning label to alert the user to this possibility. There will also be a warning label on the power supply. The user must be warned not to open up the power supply, obscure the vent openings, or stick things into the vents. In the user manual, the user must also be notified that the cord leading from the power supply to the device should be placed in such a way to discourage tripping over the cord or in any way removing the cord. They will be warned not to use the device if the cord is frayed or compromised in any fashion.

3.0 Environmental Impact Analysis

Frank Splitt has put a great deal of emphasis on engineering in respect to environmental solutions, to the extent that he believes “environmental factors need to be considered at the beginning of every engineering problem [1].” It may be a credit to the revised ABET standards, the fact that our generation is more environmentally minded, or simply just the nature of our project that the Drink Mixer is an environmentally friendly device.

The current prototype of the Drink Mixer contains a fair amount of lead due to the eight PCB’s that are contained within it. Lead is also contained in the solder used to attach components to the boards. Lead is extremely hazardous to the health of humans, plants, and animals; contact in humans occurs most often through inhalation or ingestion of lead [2]. With this prototype, there need only be warnings not to open the packaging, but for future devices the PCB’s can be made with a lead-free solder finish at no additional charge [3]. Lead free solder can also be used to attach the components to the PCBs. These precautions will prevent lead from entering into the systems of any users or from polluting the environment in any way. The

reliability of the lead free solder may be a possible ethical issue, but reliability is sure to improve with time and should not be an issue with this project [4].

During normal use the Drink Mixer will not adversely affect the environment. The user will be advised to turn the device off when not in use in order to conserve electricity, but there is no reasonable chance of harm while the device is running.

The packaging is made entirely of aluminum and can be easily recycled by the user. Aluminum does not break down through recycling and most places that recycle aluminum cans will also recycle scrap aluminum [5].

The touch screen LCD contains mercury and neon within the CCFT [6]. Mercury is extremely poisonous, hazardous to the environment as well as the user, while neon is a rare element. The user will be notified in the user manual that the screen will need to be disposed of properly through household hazardous waste collection centers [7]. Locations of collection centers for each state can be found on the website for the Environmental Protection Agency.

4.0 Summary

The Drink Mixer has the ability to become an ethical and environmentally friendly product. This will be dependent on how vigilant we are in testing the device to ensure that there are no issues with the software. It will also rely on how faithful the user is to usage and disposal requirements. If the device is used and disposed of as specified, there should be no harm caused to the user or the environment.

List of References

- [1] F. Splitt, "Environmentally Smart Engineering Education: A Brief on a Paradigm in Progress," in *Engineering Education Reform: A Trilogy*, 2003, pp. 2.
- [2] "Lead Poisoning," [Online] Available: http://en.wikipedia.org/wiki/Lead_poisoning [Accessed: Nov. 18, 2009].
- [3] "FAQ – Lead Free PCBs," *Advanced Circuits*, 2007. [Online] Available: http://www.4pcb.com/index.php?load=content&page_id=238. [Accessed: Nov. 17, 2009].
- [4] T. Adams and K. Gurnett, "Achieving reliability with lead-free solders" *Military & Aerospace Electronics*, January 2008. [Online] Available: http://mae.pennnet.com/display_article/317439/32/ARTCL/none/none/1/Achieving-reliability-with-lead-free-solders. [Accessed: Nov. 19, 2009].
- [5] "Recycling Aluminum Cans – Fun Facts" *Professor's House*, 2007. [Online] Available: <http://www.professorshouse.com/your-home/environmentally-friendly/recycling-aluminum-cans.aspx>. [Accessed: Nov. 18, 2009].
- [6] "CCFT Tutorial," Sharp Electronics Corporation, 2009. [Online] Available: <http://www.sharpsma.com/Page.aspx/americas/en/3e22ebcf-8255-43a5-9091-4969cfd3f85d>. [Accessed: Nov. 19, 2009].
- [7] "Table of Products that May Contain Mercury and Recommended Management Options," *U.S. Environmental Protection Agency*, October 2009. [Online] Available: <http://www.epa.gov/osw/hazard/tsd/mercury/con-prod.htm#t1c8>. [Accessed: Nov 19, 2009].