

Homework 12: Environmental Impact Lifecycle Analysis and Ethical Challenges

Team Code Name: Beat Square

Group No. 1

Team Member Completing This Homework: Jonah Ea

E-mail Address of Team Member: jea @ purdue.edu

Evaluation:

SEC	DESCRIPTION	MAX	SCORE
1.0	Introduction	5	
2.0	Environmental Impact Analysis	40	
3.0	Ethical Challenges	40	
4.0	Summary	5	
5.0	List of References	10	
	TOTAL	100	

Comments:

1.0 Introduction

Beat Square is a user-interactive touch matrix consisting of sixty-four push buttons contained within an 8x8 grid. Each of the buttons has RGB LEDs contained underneath which light up when enabled and produce multi-tone audio. Beat Square may face many challenges before it comes to the market in terms of minimizing its adverse effects on the environment and sustainability during its whole life-cycle. Hazardous chemicals are used for electronic parts production of the product and ethical considerations must be taken into account of to prevent misuse and harm to consumers when using Beat Square. At the end of its life-cycle, Beat Square must also be able to become disposed of while effectively lessening unsafe waste material. In addition, Beat Square will have to undergo proper testing to prevent product instability and potential harm to its consumers while advocating awareness of safety precautions and e-waste recycling for ethical reasons.

2.0 Environmental Impact Analysis

During the production phase of Beat Square, it must first have all its individual electrical components be produced first. These parts include IC's, LCDs, push buttons, and LEDs. The resources required to producing semiconductor parts on average for one day may consist of over 240,000 kWatts of power and 2 million gallons of water. The waste generated from the plants may contaminate drinking water near surrounding communities [1]. LCDs also have an adverse effect on the environment as well since it uses sulfur hexafluoride and hydrochlorofluorocarbons for manufacturing. These chemicals are responsible for contributing to the global warming effect and depletion of the ozone layer respectively [2]. The individual manufacturing of Beat Square's different electrical components alone already have a substantial effect on the environment.

The next phase of production is the PCB manufacturing. This process requires a multitude of steps in order for a circuit pattern to be created. Formaldehyde, dimethylformamide, and lead are common chemicals that are used in creating PCBs. Workers in manufacturing plants are constantly exposed to these toxins which can lead to deteriorating health and illness [3]. The waste produced from PCB manufacturing includes metals, strong acids, and bases [9]. Manufacturing centers should thus recycle any leftover materials to minimize waste generation.

Lastly, the final phase is assembly and packaging of Beat Square. Many products use plastic as a material for packaging products. However, on average, it may take over twenty to thirty years for plastic to decompose [6] and so it would be beneficial to limit the use of it. For its packaging and distribution, Beat Square may use minimal plastic to hold instruction manuals and power plugs. The packaging box would be produced from cardboard material. Since the instruction manuals and cardboard box are made from trees, they will be environmentally friendly. Even so, one way to limit paper and plastic waste is to include in the box only paper pamphlets of necessary product safety concerns. The user manual would be posted online and the plastic packaging would not be needed.

Beat Square during its normal operation affects the environment in a very minimal way. The product requires only 5-volts and 1 amp of current to power the entire electronic circuit. This means Beat Square uses 5 Watts of power. According to the U.S. Energy Information Administration, the average American household may use up to 10,837 kWh a year and 903 kWh a month [7]. Under normal use, consumers most likely may not use Beat Square for hours on end and will not have a massive effect on power consumption.

At the end of Beat Square's product life-cycle, it is necessary to account for the environmental effects of disposal. Electronic waste is generated at a rate of 40 million metric tons a year and some of the metals that reside within these parts are not biodegradable [8]. Nonetheless, the disposal of electronic products is ultimately in the hands of the consumer, and it is not likely that one can change the chemical processes needed for manufacturing. Thus, to promote Beat Square as eco-friendly, it should encourage and bring awareness to the importance of recycling e-waste. Pamphlets and labels inside the packaging should let the consumer know of recycling programs for e-waste so that it is more accessible to them.

3.0 Ethical Challenges

Beat Square's most notable feature is its LED display which can light up columns on the matrix in various colors. As such, it is also important to note the adverse effects that can happen to humans when exposed to flashing patterns of lights. One out of every hundred people may be affected by seizures [4] and precautions need to be taken for Beat Square to minimize harm to consumers. The most common range of frequencies that can trigger a seizure is between 3-30 Hz

[4]. This falls within the frequency range of Beat Square which is within 2-4 Hz at 120-240 BPM. Thus, this product must include within its user manual the potential for harm, highlighting the fact that Beat Square is able to produce flashing columns of light that can induce seizures. Red warning labels should be placed on the packaged box and on the product itself to make sure the consumer sees it.

At normal operating conditions, Beat Square uses 5 volts to power all of its electronic parts. Some of the IC's, including the Tiva microcontroller use 3.3 volts and use a voltage translator. The operating range of commercial products can range between 0° - 70° C [5]. Testing of Beat Square must be done within this range to ensure safe use and must include within the user manual this recommended temperature range of use. Beat Square should not be submerged in any kind of liquids either. Also, one of the most common labels required on electronic products, a warning of electric shock caused by misuse or failure of the product, should be advertised on the box.

Other ethical considerations include awareness of who may be using Beat Square. The product manufacture must account for the age range of consumers. Since Beat Square is targeted towards people of all ages, it is especially important to take precaution under use from toddlers and young children. The SD card and user push buttons, if detached, are small enough that young children would be able to swallow. Thus; the card slot should be carefully placed where they cannot reach and the push buttons need to be tightly secured and fastened to packaging. A common warning label for children under the age of five should be placed as well.

4.0 Summary

The contents of this report provide an in-depth look at the environmental effects of Beat Square during its transition from a design to a marketable product. This period includes the manufacturing of electronic parts, packaging and distribution, normal operation of the product, and product disposal. Furthermore, concerns in each step of this product's life-cycle are addressed to ensure priority for sustainability of the environment. Ethical challenges of Beat Square are also discussed which comprises product testing and safety concerns; moreover, this issue will take into consideration the consumer's health and well-being during operation of the Beat Square product.

5.0 List of References

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