

Project Design:

Standards and Codes

Sweet Dreams

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IEEE P360 - IEEE Draft Standard for Wearable Consumer Electronic Devices - Overview and Architecture

The IEEE Standard for Wearable Consumer Electronic Devices is significant to our project as it outlines the specific technological requirements to make wearable devices secure and suitable for wear. The code affects our design as it defines technical requirements and testing methods that we will have to follow to make the device safe [1].

IEC 60601-1 Medical Design Standards for Power Supplies

IEC 60601-1 is a series of technical standards for the safety and effectiveness of medical electrical equipment [2]. It is significant to our project as it addresses the basic safety and essential performance requirements of medical electrical equipment. Our project revolves around a self-defense wearable that may collect heart rate data. The standards give us guidance on the product requirements such as isolation, creepage and insulation clearance to ensure the device is safe for the user. However, not all countries do not comply with the same requirements. For example, China and Taiwan have only adopted the 2nd edition of the standard but the United States, Canada, and Europe have already fully adopted the 4th edition requirements [2]. Therefore, when making design decisions, we must take additional consideration into our market to ease the compliance process.

IEC 60335-2-76 Ed 2.1 Household and similar electrical appliances – Safety

The International Electrotechnical Commission (IEC) household and similar electrical appliances standard is important to our project as it sets the safety requirements for electroshock devices. This standard affects our design as it sets a limitation on the maximum rated voltage of our stun gun [3].

UL 69 Standard for Electric-Fence Controllers

The UL 69 standard may be meant for electric-fence controllers used only for the control of animals but is still used to verify the safety for Conducted Electrical Weapons (CEW) [4]. During two IEEE conferences, papers were released detailing how the safety of certain CEWs

relates to relevant standards, “Electrical safety of conducted electrical weapons relative to requirements of relevant electrical standards” [5] and “New conducted electrical weapons: Electrical safety relative to relevant standards” [6]. Both papers consider the UL 69 standard as it covers portable electric-fence controllers with peak-discharge or sinusoidal-discharge output for battery circuits of 42.4 V or less. Our team is creating a non-lethal weapon; therefore, this standard should be used to verify the safety of our device. These standard details load requirements and a Current vs. impulse duration graph [4]; too high of a current or a long impulse can have fatal or harmful effects. This will affect our circuit design for the CEW portion of our final product so that the final device is safe to use.

IEC 60479-1 2 Effects of Current on Human Beings and Livestock

The International Electrotechnical Commission (IEC) Effects of Current on Human Beings and Livestock is significant to our project as it explains the thresholds and limits of current that can pass through the human body. With these standards, it explores the safety concerns with each range of current and consequences with as mild as a tingling sensation and as severe as death. Since our jewelry has a taser, we will be passing a current and a large voltage into a human being and thus our electrical components must be fine-tuned in order to meet the standards and not cause unnecessary harm. These standards will affect our decisions in purchasing components such as capacitors as they must have the correct voltage rating in order to produce the correct range of current. Measurements that will affect these decisions will be the average resistance of the human body (provided within the standards documentation) and the current range the device will operate at [7].

References

- [1] “IEEE p360 - IEEE Draft Standard for Wearable Consumer Electronic Devices - overview and Architecture,” IEEE SA - The IEEE Standards Association - Home. [Online]. Available: <https://standards.ieee.org/project/360.html>. [Accessed: 29-Oct-2021].
- [2] “IEC 60601-1 Medical Design Standards for Power Supplies,” CUI Inc, 22-Jul-2020. [Online]. Available: <https://www.cui.com/catalog/resource/iec-60601-1-medical-design-standards>. [Accessed: 29-Oct-2021].
- [3] “IEC 60335-2-76:2018, Household and similar electrical appliances - Safety - Part 2-76: Particular requirements for electric fence energizers,” IEC Webstore, 29-Jun-2018. [Online]. Available: <https://webstore.iec.ch/publication/60232> [Accessed: 29-Oct-2021].
- [4] Underwriters Laboratories, UL Standard for Electric-Fence Controllers, UL 69 10th Ed, 2009, Northbrook, IL: UL Laboratories.
- [5] D. Panescu, M. Nerheim and M. Kroll, "Electrical safety of conducted electrical weapons relative to requirements of relevant electrical standards," 2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), 2013, pp. 5342-5347, doi: 10.1109/EMBC.2013.6610756.
- [6] D. Panescu, M. Nerheim, M. W. Kroll and M. A. Brave, "New conducted electrical weapons: Electrical safety relative to relevant standards," 2017 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), 2017, pp. 2185-2190, doi: 10.1109/EMBC.2017.8037288.
- [7] “Effects of current on human beings and livestock - Part 1: General aspects,” IEC 60479-1:2018 | IEC Webstore, 13-Dec-2018. [Online]. Available: <https://webstore.iec.ch/publication/62980>. [Accessed: 29-Oct-2021]