PRODUCT DESIGN FOR REPAIRABILITY: IDENTIFYING FAILURE MODES WITH TOPIC MODELING AND DESIGNING FOR ELECTRONIC WASTE REUSE

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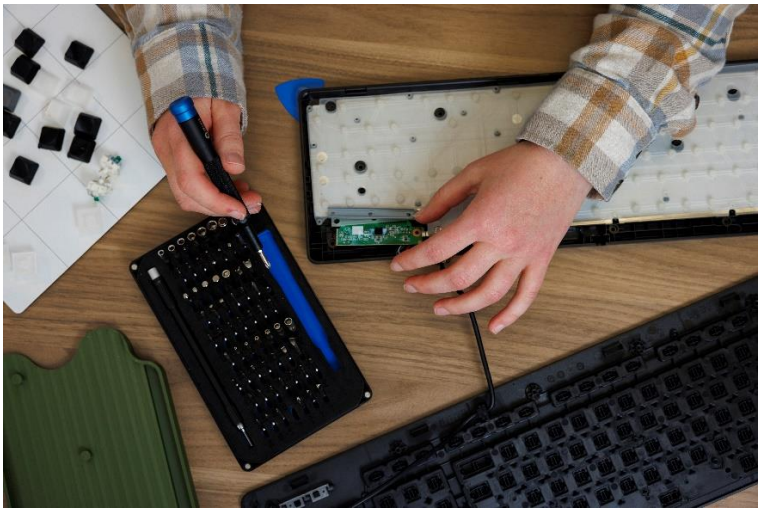

Design for repairability is imperative to making products that last long enough to justify the resources they consume and the pollution they generate. While design for repairability has been gaining steady momentum, especially with recent advances in Right to Repair legislation, there is still work to be done. This research explores the use of topic modeling (a natural language processing technique) to extract repairability design insights from online customer feedback. This could help repair-conscious designers identify areas for redesign to improve product repairability and/or prioritize components to provide as available replacement parts. Non-Negative Matrix Factorization (NMF) and BERTopic approaches are used to analyze 5,000 Amazon reviews for standalone computer keyboards to assess device failure modes. An accelerated product design process for a keyboard is presented to showcase an application of the topic modeling results, as well as to demonstrate the potential for product design that uses a "piggybacking" design strategy to reuse electronic components. This work indicates that topic modeling is a promising approach for obtaining repairability-related design insights and demonstrates the efficacy of product design to reduce e-waste.

A Thesis Defense in Mechanical Engineering

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