Undergraduate Thesis Prospectus

Connecting People and Companies to Eco-friendly EWaste Recyclers

(technical research project in Computer Science)

Obstacles to Recyclability: The Mounting EWaste Problem

(sociotechnical research project)

by

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.
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General Research Problem

How have ewaste recycling practices fallen short of environmental standards?

Since the 1990s the world has seen a technology boom that has come to affect all aspects of life. Although raising the standard of living for many, this new technology contains dangerous chemicals and materials that rarely get disposed of in a safe way (Seeberger et al., 2016). This will have profound implications on an already strained environment, and will disproportionately affect people of lower socioeconomic status (Beaudrie, 2014). In order to remedy this growing issue, it must first be understood what failures are taking place in the electronics recycling process.

Accessible Disposal: Connecting EWaste Recyclers to Consumers

How can ewaste recyclers connect with consumers trying to safely dispose of goods?

This will be a solo capstone project in the CS department, with my advisor being Aaron Bloomfield. It involves creating an application to provide people and businesses with comparisons of ewaste recycling providers near them. The goal is to expand access to environmentally friendly ewaste recyclers. Old electronics frequently end up in landfills, largely due to a lack of convenient access to electronics recyclers (Cho, 2020). By creating a tool that easily connects recycling providers to regular people and large businesses, some of the barriers to safe electronic disposal can be removed.

A constraint on this project would be the source of data for the app. Comparing environmental standards between electronics companies will be difficult to find information on, and wherever the information is retrieved from will have to be heavily vetted. The most comparable state of the art to this project would be consumers googling ewaste recycling near

them. This fails to address many barriers that arise with ewaste disposal, such as not displaying whether the recycling provider is environmentally friendly or how much recycling certain items will cost. The project will be implemented through an application building framework such as Django. It will pull data from ewaste recyclers' websites about their pricing, and will use third party websites to gain information on the environmental efficacy of the recycling providers. At the end of the project there will be a functioning website that can support a large number of users, which will allow anyone to easily access information about recycling providers near them. This will reduce some of the difficulty that results in ewaste being thrown in landfills and shipped overseas, and be a first step in the direction of eco-friendly ewaste disposal.

A Mounting Problem: Why EWaste Has Not Been Addressed

How have electronics manufacturers and recyclers resisted efforts to reduce waste?

Ewaste volumes are rising worldwide, and the trend is accelerating (Rasnan, et al., 2016). Despite growing participation in recycling programs, Seeberger states that in 2012 consumers were still disposing as much as 71 percent of their ewaste in landfills. Much of this waste finds its way to poor communities in places far away from where it was first disposed (Beaudrie, 2014). Device manufacturers and other interest groups have resisted efforts to improve recyclability and diminish ewaste (Westervelt & Beckham, 2015).

There is a wealth of published research on the amount of ewaste that is being produced and where that waste is ending up. According to Seeberger (2016), in 2012 48.9 million metric tons of ewaste were produced; 65.4 million were projected for 2017. As electronics have proliferated and as device longevity has declined, disposal rates have risen (Gabrys, 2011). Seeberger (2016) estimates that 23 percent of U.S. ewaste is exported to developing countries,

but Westervelt and Beckham (2011) contend that since such exports are unregulated, the actual rate may be far higher: perhaps 80 percent.

This lack of regulation also causes the United States to be the largest exporter of ewaste to developing countries. These developing countries lack the resources to properly address the incoming waste. Conditions are harmful for workers, and detrimental to the environment. It is in the interest of electronics producers and recyclers to leave exports unregulated. Companies actively fight to keep data on the matter private in order to keep costs down (Beaudrie, 2014).

Participants in this standoff include environmental advocacy groups, electronics companies, ewaste recyclers, consumers with old electronics, and workers in developing countries. Advocacy groups have promoted reuse and repair of old electronics that would otherwise be disposed of, while fighting for improved regulation on ewaste disposal (ERA, n.d.). To reduce ewaste, the Electronics Recycling Association informs consumers about device longevity, recycling, and environmentally safe disposal, and promotes ewaste regulation.

Some hardware manufacturers oppose stricter ewaste standards, but others market their products in part for their recyclability. Apple is fighting the right to repair (Apple, n.d.), raising barriers to reuse of electonrics. By impeding device repair through third-party vendors, Apple limits the lifetime of its products and compels consumers to replace them instead. In its public relations, Apple draws attention to its clean energy policies, but is silent about its practice of reducing battery quality over time to compel consumers to replace its products (Apple, 2020a; Apple, 2020b). HP simplifies device repair through robust support websites that help consumers keep their products working (HP, n.d.). The company thereby earns standing with its consumers and with its business clients. In a 2017 statement, HP claims a commitment to reducing its products' environmental impact and to promoting easy reuse and recycling (HP, 2017).

By meeting environmental standards, electronics recyclers can attract business from environmentally minded clients (Securis, 2013). Nevertheless, we cannot know exactly how much "recycled" material the U.S. exports to developing countries (Westervelt & Beckham, 2011). Many consumers still elect to dispose of their waste in landfills. For consumers, recycling can be inconvenient or expensive. One told a reporter: "Some places charge you to drop off, other places have very strict hours, while others only accept certain things." "The whole thing needs to be easier" (Ioffee, 2019).

Workers in developing countries process the world's ewaste. Most live in poor conditions and rely on the metals and materials they salvage for their livelihoods (Beaudrie, 2014). Stricter standards could compromise their means of earning an income. Many recycling practices are hazardous to recyclers' health and to local environments. Even at recycling sites with skilled workers, valuable scrap often accumulates in dumps, where it is burned (Westervelt & Beckham, 2015). Ewaste disposal, especially burning, contributes to greenhouse gas emissions. The infrastructure necessary to manage ewaste generally does not keep up with needs (Rasnan, 2016).

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