

Recycling Educational Website for Charlottesville

(Technical Paper)

Motivation for Recycling and How to Best Educate the Community

(STS Paper)

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On my honor as a University Student, I have neither given
nor received unauthorized aid on this assignment as defined
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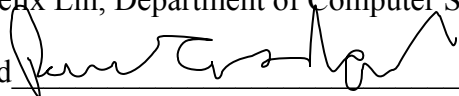
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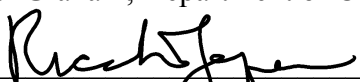
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Introduction

Recycling is often regarded as one of the best strategies in the fight against climate change and the reduction of the amount of waste going into landfills. Understanding the motivation for recycling, a technical project will be done in an attempt to increase the amount of recycling done in the Charlottesville area with a target user of college students and young adults.

For people who live in Charlottesville, finding out how to correctly recycle should be easier. Currently, there are many outdated websites available that must be combed through in order to understand what can be recycled and where to take it. This paper discusses the implementation of an educational online website that shows everything needed to know relating to recycling in Charlottesville. It will discuss the design of the user interface, the mechanics of how it will work, and how a user would utilize the service. The focus of the service will be on ease of use through an intuitive interface and a single location to find any and all information needed. The information included will be knowledge such as what items can be placed in city bins, the options available for items that cannot be, and the options for composting. If this information were more easily understandable and accessible, the number of people who participate in recycling would be expected to increase.

In order to supplement the technical project, research will be conducted around the benefits of recycling and its effects on climate change, supplying the overall reasons for having the technical project. Once this is complete, in order to complement the technical project, research will be conducted into the habits of citizens in recycling and what motivates or incentives them to recycle. If it is known what kind of educational barriers exist in citizens' recycling routines, a better educational resource can be crafted. The focus of the research will be on college aged students while information on the overall population will be useful too.

Technical Topic (Capstone)

The problem that is expected to be defined and addressed is the absence of clear guidelines on how to recycle, what to recycle, and where to recycle for students and residents living in the Charlottesville area. Solving this problem could lead to an increase in the amount of recycling that happens in the area which has benefits that are described in the research portion.

The website created will be built with technically challenging features to implement. The web framework Angular 10, an open source framework maintained by Google, will be used. The framework is a TypeScript based language which is a superset of Javascript maintained by Microsoft. The framework Angular was chosen for the excess of documentation available on the web and the useful features and components available to use. The design will be focused around ease of use, meaning users can quickly find answers to questions they have about recycling. Information about where to visit to recycle, what kind of materials can be recycled (e.g. types of plastic), and information about what can be placed in city bins. Being able to easily navigate to find the information will be the goal. In accordance with ease of use, the design will also be focused around a modern, intuitive design that both college students and citizens expect. To achieve this, web components (e.g. tables, navigation options, and buttons) that are stylish and beautiful but yet still useful will be programmed by using an open source component library. In order to serve a wider audience and be inclusive, the website will be responsive to different technology platforms including mobile devices, desktop computers, and web browsers and will be accessibility compliant for tools like screen readers.

The website will collect analytics about the users who visit the site using Google Analytics and will track the engagement that users have with the site. It will be able to know which pages are visited the most, where users are viewing the website from, and will track how users interact with the site. The goal, although unintuitive, will be to have users spend as little

time as possible on the site. Users spending extended periods of time on the site means that they were unable to answer their questions quickly which is not the goal of the project. By tracking time spent on the site, this will be an indication of how easy it was to find their information.

The website will be hosted for visitors using an Amazon Web Services (AWS) S3 bucket. AWS will be used because of the extensive documentation of the tools they provide, the cheap price of the service, and the reliability they provide of 99.99% availability (according to their website). The public domain 'cvillerecycle.com' is available and will be purchased through AWS to be the location on the web where the website is hosted. The security of the site will be considered by looking for potential vulnerabilities using OWASP ZAP, an open source security scanner. Many types of vulnerabilities will be considered. For example, for any kind of user input, the possibility of a cross-site scripting attack will need to be considered and handled. In order to ensure that all information sent to and from the user is encrypted in their web browser, the website will need to be hosted using the HTTPS protocol.

The approach to the project will be to first layout the design of the contents of the site. Next the implementation will be done with the design considerations already mentioned as the main focus. Beta testing will then be done with friends and technical advisors with feedback required. The implementation will then be adjusted based on the feedback received. Other factors will then be considered that includes security and accessibility compliance. Upon completion, the site will be hosted in a public domain. After the completion of the site, officials from the city of Charlottesville will be contacted in order to see if they would be interested in owning the site. Depending on if they approved the idea, the website could be referenced by official Charlottesville websites. The code could be given to the city for their own website

administrators to maintain and keep up to date. This would allow the website to be updated and contain relevant information even after the project is completed.

STS Topic

The research topic to be explored is the recycling habits of people in the United States. More specifically, when people choose to not recycle, what factors play into this decision, whether it be a conscious choice or not. Is it inconvenient for them, do they not have access to recycling centers, are they uninformed about it, is it a combination of factors, or something else?

Recycling has become a fundamental part of reducing the amount of waste that is placed in landfills. The United States produces 180 million tons of waste each year, but the Environmental Protection Agency (EPA) estimates that paper makes up 40% of waste and metal, plastic, and glass make up 23.5% of waste (Gills, 1992). This documents that there are clear areas for improvement given the amount of waste created by recyclable materials. The waste generated is a problem for climate change with the EPA suggesting that methane from landfills accounts for 4 percent of all greenhouse gas emissions (Ackerman, 2000). Not only would more recycling efforts reduce the amount of waste in landfills, it would also decrease the amount of production of new materials which also creates waste. Exploring more of the background of why recycling is needed because of the harmful effects of landfills will be done in order to provide motivation for the technical project. Most articles discussing the need for recycling and the ones used in this paper seem to have been published around fifteen years ago, and upon researching the topic, it could be found that a modern day interpretation of recycling is found to not be as useful.

Once the motivation for recycling is found, research will be done on the way that people recycle. The goal of the research will be to discover the driving factors that go into individual's waste management routines. For example, it was found that when curbside recycling is an

option that the amount of recycling is increased (Jenkins, Martinez, & Palmer, 2003). It was also found that expenditures on recycling education increased the amount of recycling done (Sidique, Joshi, & Lupi, 2010). Motivations for recycling will be researched but in particular research on the education of citizens will be focused on, as the technical project is essentially an educational tool. For example, what kind of educational tools have worked from researched districts would be useful information. If possible, the research will be more focused on the habits of college aged students and young adults, the demographic that is more likely to use the website.

After collecting the research, the information will be used to alter the technical project to focus on targeting this audience of people who do not recycle. The primary targeted user of the technical project will be people who are not able to easily find the information needed to recycle. Therefore, information about this demographic of people will be useful for the implementation of the technical project and in lowering the educational barrier to entry of recycling in Charlottesville. The technical project will be targeted toward college students at the University of Virginia but learning about overall recycling trends among people in the United States will still be useful too.

The research done will be very closely related to the technical project, and the research exists to complement and motivate the reasons for building the technical project. First the reasons for needing an increase in recycling efforts will be found and the overall impact that landfills have had on the environment. With this motivation, the recycling habits of citizens will be found and thus what can be done about to help increase the amount of recycling in the technical project.

Conclusion

Increasing the recycling efforts is the main topic of the paper including researching why to recycle, the habits of people recycling, and a practical solution to the Charlottesville area that

will hopefully lead to an increase in recycling through a technical project. The research portion exists to provide reasons why recycling is important and to help improve the technical project by understanding the habits of citizens. Over the long term the technical project will hopefully help inform people in the Charlottesville area about the options they have and therefore increase the amount of recycling that is done.

References

Gillis, A. M. (1992). Shrinking the Trash Heap. *BioScience*, 42(2), 90–93.

<https://doi.org/10.2307/1311649>

Jenkins, R. R., Martinez, S. A., Palmer, K., & Podolsky, M. J. (2003). The determinants of household recycling: a material-specific analysis of recycling program features and unit pricing. *Journal of Environmental Economics and Management*, 45(2),

294–318. [https://doi.org/10.1016/s0095-0696\(02\)00054-2](https://doi.org/10.1016/s0095-0696(02)00054-2)

González-Torre, P. L., & Adenso-Díaz, B. (2005). Influence of distance on the motivation and frequency of household recycling. *Waste Management*, 25(1), 15–23.

<https://doi.org/10.1016/j.wasman.2004.08.007>

Frank Ackerman (2000) *Waste Management and Climate Change*, *Local Environment*, 5:2, 223-229, DOI: 10.1080/13549830050009373

Sidique, S. F., Joshi, S. V., & Lupi, F. (2010). Factors influencing the rate of recycling: An analysis of Minnesota counties. *Resources, Conservation and Recycling*, 54(4),

242–249. <https://doi.org/10.1016/j.resconrec.2009.08.006>