Critically Rationalize & Justify The Why

Contaminated recycling leads to more trash entering the landfill than necessary. Landfills are very costly to build, maintain and seal off. For an environmental government worker, less items entering a landfill would mean less landfills, which is better for the environment and means a lot of savings. Additionally, closed landfills are land that must be monitored very closely to ensure that nothing escapes. As more and more landfills are made, more land is rendered unusable for nature and other human needs.

Our group members are also environmentally-conscious, and would rather contribute to a solution that sees less recycling enter a landfill. Moving entirely away from trash is ideal but currently impossible. Having an incentive for people to recycle better and become more educated on proper recycling would lead to less trash and a more renewable society.

Municipality workers are trying to find ways to cut costs from contaminated recycling, and also are trying to move our waste practices to a more sustainable approach. A solution that could bring down the amount of contaminated recycling and related payments would fulfill both of these wants.

Societal Impact

If we say that our project is going to be very successful and adopted by municipalities across North America, what would be the societal impacts on a metered waste collection system? Right now, among other home commodities like water, power, and even more niche examples like meal subscriptions, the user pays for what they use. For recycling and garbage however, as long as it fits in the bin, every user is charged the same rate. Does it make sense for a very careful person who produces a quarter of the trash as their neighbor to be billed the same way? We think that widespread adoption of this software could lead to metered garbage and recycling collection, which would incentivize people to recycle better to pay less money. This is seen in places like Sweden where intrinsic and extrinsic motivators are used to reduce waste such as fines [2].

Another potential concern with this project is privacy for the individuals and households producing the waste. Unlike other previously mentioned commodities that are charged by use, waste contains personally relevant information such as medication packaging, papers, etc., and the pictures taken from the bed of the truck could also contain parts of the neighborhood or house in the background, which could also have some personally identifiable properties. Our thoughts about dealing with this involve using some sort of image filter to only save the portion of the image that contains the truck and the waste, and additionally to only attribute waste to specific blocks of houses or even just neighborhoods. The data will also be private, and pictures won't be publicly available in any way on our front-end UI. Amalgamated data will be shown showing trends for cities/neighborhoods instead of private, fine-grained details on individual images. The finished project will have to adhere to Saskatchewan privacy legislation set out in the Local Authority Freedom of Information and Protections of Privacy Act (LA FOIP) and its regulations.

Questions & Answers

Is recycling even that good for the environment?
Would a project researching better ways to package items have more of an impact?
Is it better to fine a company for excessive packaging?

Recycling is not great for the environment, less than 10% of plastic used has been recycled, but a lot of this is due to contamination and current infrastructure [1]. Improving the efficiencies of recycling is still important to make sure that recycling that is done is not put into landfills due to contamination.

As a society, moving away from single use plastics and fining companies for excessive packaging is a way to reduce plastic waste at the source which is more effective. Fines would make it less economically feasible for companies to have excessive plastic packaging and cause an analysis of their packaging process although the alternatives used instead may have their own issues. The existing app can be extended in the future to recognize brands but would not necessarily be doable from a software side based on the current state of computer vision algorithms. If completed, this could inform legislative decisions to levy fines on companies with excessive packaging. By focusing on contamination in recycling we can reduce the need to dispose of recycled material when it is contaminated and make the process more efficient. It would be a society movement to reduce plastic on a company level which may be possible but not with the current software and object detection available in its current form. The European Union has legislation in place to fine companies that are deemed to use excessive packaging and implementing something similar in Canada could be helpful [3].

Consumers are upset with excess packaging already as mentioned in a CBC article linked below but should be noted that some packaging is to prevent damage and theft [5]. Reducing excess packaging is beneficial by *Reducing* which is the first defence and most important in the *Reduce, Reuse, Recycle* flow. *Recycling* is a final step, making it more efficient and recycling rather than disposing of waste in a landfill is still important even if reduction earlier on would be best [4].

Augmented, Manual, or Automated System?

Our system is an augmented system. Our system automatically detects contaminants but relies on manual review and analysis of data by a municipal analyst to create reports that inform and create targeted education campaigns. We are using an augmented system because waste management is an extremely complicated task and it is not one that is easily automated. Also, the manual method of auditing individual bins of recycling and applying a sticker is a time consuming and tedious process that can be automated to provide information for manual analysis. By augmenting the current process we let computers handle the daunting task of tracking contaminants, but let humans focus on providing education to the areas of concern.

Integration With Prairie Robotics

We will be developing our code in separate GitHub repositories from the Prairie Robotics team to ensure proper division of labour, but we will be using the same technologies that they are currently using with the hope that any code we create can be seamlessly integrated into their equivalent, partially existing versions of the apps we are making.

The actual running instances of our apps will also be hosted using the Prairie Robotics AWS account, so they will be integrated there in the same way as their existing code as well.

Scope Exclusions

We are not building an app for household recyclers:

We decided to not make an app for household recyclers for several reasons. The key points are we are not trained educators, communication of information to the masses only reaches so far and incentives are needed to truly motivate change. As of now, the privacy issues involved with creating a consumer-specific app (LA FOIP) make it especially challenging.

Government workers are the people that can incentivize or reprimand citizens for their recycling quality. Government workers have the infrastructure and the motivation to educate citizens how to recycle better. The current municipal governments have attempted to educate citizens on how to recycle better through information available on their website, but not enough people are seeing it. There needs to be a greater understanding of the problem to be able to solve it. We want to build the tool to help understand this complex problem. We are augmenting municipalities with the tools to solve the problem and allow for targeted education campaigns, rather than automating a solution.

Communication Is Limited

Many citizens, regardless of whether they want to recycle well or not lack the information needed to do better even if it is available. The guidelines for recycling in Regina are available to be found yet recycling quality is still very poor. If we develop an app for the average household recycler that app will possibly not be used widely. But, if municipalities know where their recycling issues are originating, they can target these trouble areas rather than spend resources trying to reach out in an untargeted manner.

Incentives Motivate Change

A municipality service that increases fees for poor recycling or reduces them for good recycling is the type of incentive needed to make significant change. Monetary incentives are only going to be able to be developed if the municipalities can monitor where their costs are coming from. An app provided to household recyclers will only be mass adopted once it can be used as a tool to lower their own costs, not just improve their ability to recycle. There is a similar system in place in Sweden which has helped reduce contamination and recycling being disposed of improperly [2]. An app in the future can help inform users and provide more transparent communication.

Why Not Sort?

   We are focusing on a preventative approach to contaminated recycling, where the goal is to educate people before they put anything in the bins. This means that once a user has recycled the wrong item, we do not try to correct that specific mistake. Our hope is that we can educate them before they make the same mistake again. Sorting recycling is extremely costly and labor intensive. If it was easy to sort recycling, we wouldn't have a problem with contaminants entering the recycling stream. If we can improve the quality of recycling at its source, we can reduce the amount of sorting required. Our goal is not to automate waste management, but to augment the current workforce with a tool that helps improve their ability to manage waste.

For Further Reading see:

[1]
https://www.cbc.ca/documentaries/the-passionate-eye/recycling-was-a-lie-a-big-lie-to-sell-more-plastic-industry-experts-say-1.5735618

[2]
https://www.buschsystems.com/resource-center/page/are-fines-for-improper-waste-disposal-the-best-way-to-increasing-recycling-rates

[3]
https://europen-packaging.eu/policy/5-eu-packaging-and-packaging-waste-directive.html

[4]
https://www.nrdc.org/stories/reduce-reuse-recycle-most-all-reduce

[5]
https://www.cbc.ca/news/business/excessive-packaging-dangerous-frustrating-for-consumers-poll-1.2490047