



## Problem Statement

- As per a 2013 Environmental Protection Agency study, an average American wastes about 4.4 lbs of materials per person every day. Majority of the recyclable items are filled in landfills.
- Based on our research, there is no distinct product that can identify all types of recyclable items with appropriate prompts to avoid intermix of trash and recyclable items.

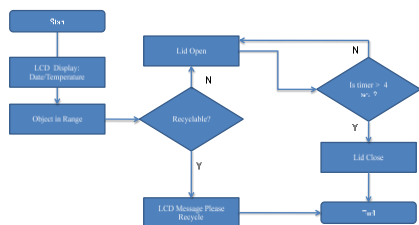
## Objective

- Efficiently segregate recyclable items from trash to save energy and the environment

## User Requirements (Goals/Constraints)

- Need a device to identify recyclable items and restrict recyclable items to be intermixed with trash.
- Needs to be weather proof and avoid damage from trash inside the container
- Needs to have display panel for friendly usability and buzzer prompting.
- Efficient proximity sensing of recyclable items.
- Scope is limited for home usage- needs further improvements for commercial usage.
- Recyclables should be fed individually to container.

## Process Flow Diagram



## Engineering Design Process

### Ask:

- Durability of the device, condition of recyclables.
- Too many recyclable items in landfills can lead to pollution.
- Recycling can save a lot of energy.

### Imagine:

- We considered 3 solution approaches and shortlisted one option - Designed a device to identify recyclable items thrown in trash bin with lid

### Plan:

- Design and development work is split into 3 modules - Metal Detector, Motion detector and Display Panel.

### Create:

- Implement above 3 modules.

### Input Devices:

#### Ultrasonic Sensor



#### Inductive Proximity Sensor



#### RTC/Temperature Sensor



### Test and Evaluate:

- Performed the unit test for each module separately and captured the test results for the relevant scenarios.

### Improve:

- In future, the prototype will be enhanced for plastic, cardboard, paper and glass.

### Share Solution:

- The key strength of the current prototype model is uniqueness of the product to deliver various capabilities like metal detection, LCD display and auto lid open/close.

### Output Devices:

#### LCD



#### Piezo Buzzer



#### DC-Servo



## R<sup>3</sup> Prototype

### Arduino Mega 2560



### Front View



### Top View



### Open View



### Integrated Device Box



Reduce landfills, use R3 device, to save the environment

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Recycling 1 ton of plastic can save an equivalent of 2 peoples energy for 1 year.

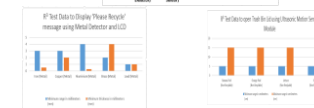
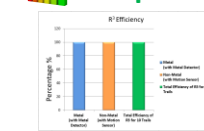
Manufacturing products for recycled paper and plastic reduces water pollution by 35% and air pollution by 73%.

One plastic bottle can save enough energy to power a 60 watts light bulb for 6 hours.

It takes about 25 recycled bottles to make a fleece jacket.



## Graphs



## Conclusion

The device has foundational framework with focused capabilities but has potential to be fully extendable to meet broader diversified needs

### Key Advantages

- Minimizes intermixing of recyclable with trash in turn helps
  - Reduction of chemical toxic gases generation from Landfills
  - Increased Opportunity on recycling and saves energy

### Key Strengths

- Supports metal detection to avoid intermixing with trash and provides recycle opportunity
- The device is very user friendly - displays a LCD message and buzzer to prompt user to recycle the item
- If the item is recyclable, the lid does not automatically open



## Recommendations

Consider below capabilities for future enhancements for multi iteration releases for full blown product

- Plastic, cardboard, paper and glass sensing are must have capabilities
- Notification to user's phone with recycled material data would be a valuable addition in the future.
- Extend product capabilities from residential to commercial usage.

