



## ? Problem Statement

- As per 2013 EPA (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

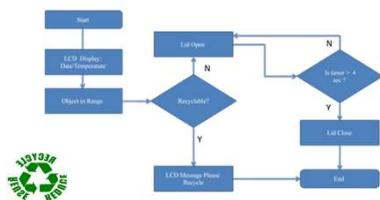
- Efficiently segregate recyclable items from trash to save energy and the environment



## 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 option - Designed a device to identify recyclable items thrown into a trash bin with a lid

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

**Create:** Implement above 3 modules.

### 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 s

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## Facts

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

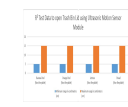
Manufacturing products for recycled paper and pl reduces water pollution by 35% and air pollution by 73%

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 recyclable data is nice to have future
- Extend product capabilities from residential to commercial usage.



## Input Devices:

Ultrasonic Sensor



Inductive Proximity Sensor



RTC/Temperature Sensor



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

Arduino Mega 2560



Front View



Top View



Open View



Integrated Device Box



**BUDGET**

Item	Qty	Unit Price	Total Price	Remarks
Arduino Mega 2560	1	\$12.00	\$12.00	
Ultrasonic Sensor	1	\$5.00	\$5.00	
Inductive Proximity Sensor	1	\$3.00	\$3.00	
RTC/Temperature Sensor	1	\$2.00	\$2.00	
LCD Display	1	\$1.00	\$1.00	
Piezo Buzzer	1	\$0.50	\$0.50	
DC-Servo	1	\$1.50	\$1.50	
Wires	1	\$0.50	\$0.50	
Case	1	\$1.00	\$1.00	
<b>Total</b>			<b>\$26.50</b>	



Reduce landfills, use R<sup>3</sup> device, to save the environment