THE USE OF SMART WASTE MANAGEMENT TO REDUCE THE EXCESSIVE USE OF ENVIRONMENTALLY HARMFUL PRODUCTS

GREEN WALLET

An innovative approach towards a sustainable waste reduction

Introduction

-Problem statement

Applying smart waste management to reduce environmentally harmful products by using a smart waste sorting machine supported by a green wallet app that reward points for the users.

-Constraints

1-size
2-capacity
3-slower time to sort
4-limited number of products
5- sorting specific shapes only
6-not efficient organic waste separation

-System components

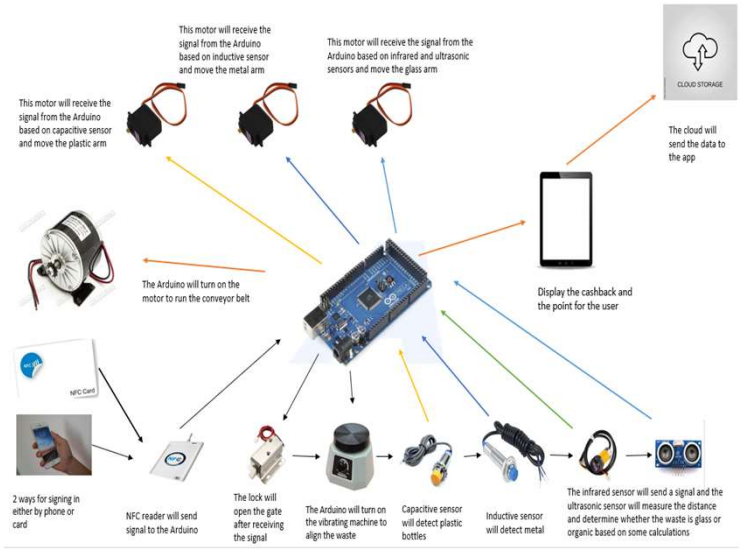
- A waste sorting machine
- Green wallet app

-How does the system work

1. The user buys a product certified by us or throws a waste he has in the waste sorting machine
2. The user will get points/cashback based on the type of waste and the price

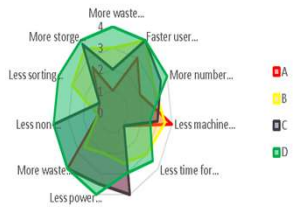
When the user gets consistent with buying green products, he will be awarded if he wins in the annual competition.

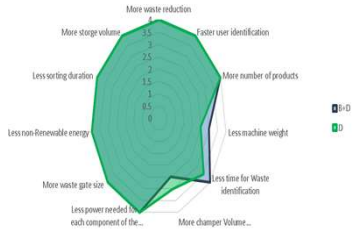
Digital design



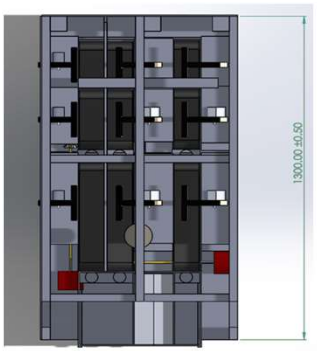
Prototype Design

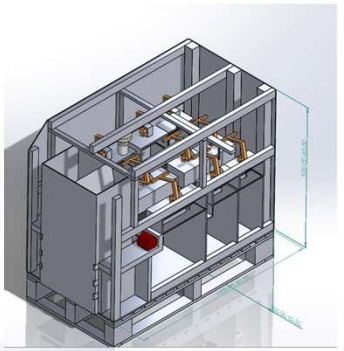
We came up with four different designs each has its advantages and disadvantages, then we combined two designs to active the best outcomes, here are spider charts to show the score of each design and the combination between the best designs:

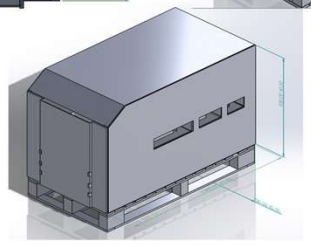




The final design is made up with 3 main parts: the base, the structure and the main body that has all the components. We designed a strong base to prevent any bending for the machine body and we designed a structure that will support the machine because we have vibrations and, we have a heavy solar panel on the top. Inside the machine body there is a drawer which the user use to put his garbage, containers for each type of waste (plastic, metal , glass and organic). Arms with servo motors to push the trash in its container, sensors to detect the waste and conveyor belts(using a 250 W motors and 8 mm shafts) to move the waste along the machine. Here are some pictures of the final machine prototype design:







The final main dismissions are :0.93 m (without the base), 1.3 m length and 0.7 m width. The machine . And here is the specification of the machine.

Specification	Expected
Storage volume (+-5%) (m^3)	Plastic = 0.010395 Organic= 0.06468 Metal= 0.05775 Glass= 0.0462
Sorting duration (+-25 %)	7 min
Renewable energy use (+-3%)	600 W a day, 1.9 kwh needed
Waste gate size (+-5%)	0.12 m^2
Power (+-10%)	1900 W
Chamber volume	0.4416 m^3
Time for waste identification (+- 15%)	20 S
Estimate Machine weight (+-5%)	93 Kg
Number of products (+- 15%)	30 in the app and 6 in the sorting machine
Time for user identification (+- 3%)	1 s
Waste reduction (+- 10 %)	30 %

Testing/Validation

Storage volume:

PLASTIC	METAL	GLASS	ORGANIC	TOTAL
0.101019 m^3	0.055719 m^3	0.044982 m^3	0.06576 m^3	0.26748 m^3

Renewable energy use:
0.6 Kw a day because of the average of bright sunlight time in Saudi Arabia is 8.89 hours which is likely will make us reach that target Because using solar panels that generate 100 W requires only a 6 hours of bright sunlight

Waste gate size:

A=0.4*0.1*3= 0.12 m-2

Power:
We have 17 components that use elecrtcity, the total power consumption is 1988.035 W

Chamber volume: V= 0.26748 (VOLUME OF CONTAINERS) +0.36845(SPACE ABOVE CONTAINERS AND BELTS) =0.63593 m-3

Time for waste identification:
Estimated 20 seconds considering the AI speed to gather the information and compare it with the data base.

Sorting duration :
Considering the 20s for identification in each station x3 , 60s in each station x 4 so the total is 5 minutes which is 40% lower than the prediction.

machine weight:
Calculating the mass of the wood used to build the body and the mass of the internal components the total weight is = 97.904 Kg

Number of products:
We have 3 compartment and 2 paths, so the total is 6 products in machine and 30 in app.

User identification :
Using the NFC reader; the user identification time is 1-2 seconds.

Waste reduction:
Based on statistics, 75 % of plastic, 100 % of aluminum, and 100 % are recyclable. Our machine has recyclability, reusability and environment impact, which means it indeed can reach to more than 30 % waste reduction.

Conclusion

To sum up, smart waste management systems that combine garbage sorting machines with incentive programs present a viable alternative for reducing waste pollution, increasing recycling, and promoting sustainability. These systems leverage advanced technologies to simplify and incentivize the waste sorting process, improve the accuracy of waste classification, and track individuals' waste reduction efforts. These systems can drive individuals to embrace a more conscious lifestyle and contribute to pure, healthier, and more acceptable societies by promoting environmentally friendly practices with giving actual profits.

Our Team

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