



## Introduction to Engineering Design (GE 105)

# Future Shopping Carts

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Names:

# Problem Introduction



Studies show that 24,000 kids are injured or hurt annually in the United States due to the shopping cart child seat.

# Targets

Our targets are:

- ❖ Hypermarkets
- ❖ Malls
- ❖ Stores

# Need Analysis

- Must have multiple shelves for different products organization and safety
- Should be able to withstand at least 70kgs
- Durable, rustproof light metal
- The metal must not be sensitive to extreme temperature(cold or hot products)
- A refundable coin must be inserted to use the cart
- A delicate swivel, durable thermoplastic rubber wheels to ease the movement
- A delicate disposable rubber handle that's smooth on hand

# Need Analysis

- The size should be around [1.3m(L) by 1m(h) by 0.7m(w)]
- Ease of movement
- The wheels should be corrosion-resistive
- Must be safe
- Must have some kind of lock to stop it from moving by itself
- It shouldn't cost more than 450 Saudi Riyal
- It should be easily used and maintained

# Objectives

## Primary objective(s):

To design a cart that has multiple shelves for different products' organization and safety

## Secondary objectives

To enhance absolute people's safety and comfort

To become a durable, rustproof cart

# Constraints

- Should withstand at least 70kgs
- The size should be around (1.3 m(L) by 1 m(h) by 0.7 m(w))
- Should not cost more than 450 Saudi Riyal
- The metal should not be sensitive to extreme temperatures



# Criteria

Durable material

Easily used and maintained

Safe

Organizable products

# Problem formulation




- The shopping cart must have multiple shelves which help in products' organization and safety. Also, it should increase the safety and comfort of the users. The size of the cart should be 1.3m(L) by 1 m(h) by 0.7 m(w). It should be made of durable light metal and able to withstand at least 70 kilograms. The metal should not be affected by extreme temperatures, as well. The cart should be easily used and maintained while also having a delicate handle and smooth wheels. This future cart shouldn't cost more than 450 Saudi Riyal.



# Needed information

- Different types of durable light materials
- Thermoplastic rubber features
- Different kinds of wheel locks
- Extreme temperatures of products sold in markets
- Cost of all materials used in building the cart

# Morphological Analysis

Function	1	2	3	4
Material	Steel	Plastic	Wood	Aluminum
Shape	Rectangular 	Trapezoidal 	Parallelogram 	Circular 
Movement mechanism	Hand pushed	pedaled	Roller belt	Electronic control
Wheels' material	Rubber	Plastic	Steel	Thermoplastic rubber
Shelves organization	Randomly	Equally distanced	Half big, half small	
Shelves shape	Triangular	squared	rectangular	circular

# Ideas Elimination

1. [ steel, rectangle, hand pushed, rubber, randomly, triangular ] **eliminated(impractical)**
2. [ aluminum, parallelogram, electronic control, rubber, equally distanced, Squared] **eliminated(costly)**
3. [ wood, rectangle, hand pushed, rubber, randomly, circular ] **eliminated(impractical)**
4. [Aluminum, Circular, Pedaled, Rubber, Half big, half small, Squared] **eliminated(impractical)**
5. [Wood, trapezoidal, roller belt, thermoplastic rubber, random squared] **eliminated(costly)**
6. [ steel, rectangular, electronic control, thermoplastic rubber, equally distanced, rectangular] **eliminated(costly)**
7. [ steel, circular, pedaled, steel, randomly, circular ] **eliminated(uncomfortable)**
8. [ steel, squared, hand pushed, steel, randomly, triangular ] **eliminated(uncomfortable)**
9. [ Plastic, parallelogram, pedaled, steel, random, circular] **eliminated(impractical, uncomfortable)**
10. [ aluminum, parallelogram, electronic control, rubber, equally distanced, squared ] **eliminated(impractical)**
11. [ aluminum, parallelogram, electronic control, rubber, Half big, half small, squared ] **eliminated(impractical)**
12. [ aluminum, circular, roller belt, steel, random, rectangular] **eliminated(impractical, uncomfortable)**
13. [ plastic, parallelogram, electronic control, rubber, Half big, half small, squared ] **eliminated(impractical)**

# Ideas Elimination

- [ plastic, rectangle, hand pushed, steel, equally distanced, squared ] accepted
- [ aluminum, rectangle, hand pushed, steel, equally distanced, squared ] accepted
- [ aluminum, normal shape, hand pushed, thermoplastic rubber, Half big, half small, rectangular] accepted
- [ aluminum, trapezoidal, hand pushed, rubber, Half big, half small, squared] accepted
- [ Steel, trapezoidal, hand pushed, thermoplastic rubber, Half big, half small, squared] accepted
- [ aluminum, trapezoidal, hand pushed, steel, Half big, half small, rectangular] accepted
- [Plastic, rectangle, hand pushed, rubber, randomly, squared] accepted
- [Steel, trapezoidal, hand pushed, thermoplastic rubber, equally distanced, triangular] accepted
- [ plastic, trapezoidal, hand pushed, thermoplastic rubber, equally distanced, squared ] accepted
- [ plastic, trapezoidal, hand pushed, thermoplastic rubber, half big, half small, squared ] accepted

# Criteria for selection

Scenarios	Durability	Easily used and maintained	Safe to use	Products organization
#1. Easy to make	20	40	20	20
#2. Safe and organizable products	25	10	25	40
#3. Safe	30	15	40	15

# Ratings

Scenario #1 (easy to make)	Durability	Easily used and maintained	Safe to use	Products organization	Score
Weight	20	40	20	20	
[aluminum, normal shape, hand pushed, thermoplastic rubber, Half big, half small, rectangular]	8	5	7	9	680
	160	200	140	180	
[ plastic, normal shape, hand pushed, thermoplastic rubber, equally distanced, rectangular]	6	6	6	8	640
	120	240	120	160	
[Steel, rectangle, hand pushed, rubber, randomly, squared]	5	7	5	3	540
	100	280	100	60	
[Plastic, rectangle, hand pushed, rubber, randomly, squared]	3	7	6	3	520
	60	280	120	60	
[Steel, normal shape, hand pushed, thermoplastic rubber, equally distanced, triangular]	7	6	6	3	560
	140	240	120	60	

# Ratings

Scenario #2 (safe & organizable products)	Durability	Easily used and maintained	Safe to use	Products organization	Score
Weight	25	10	25	40	
[aluminum, normal shape, hand pushed, thermoplastic rubber, Half big, half small, rectangular]	8	5	7	9	785
	200	50	175	360	
[ plastic, normal shape, hand pushed, thermoplastic rubber, equally distanced, rectangular]	6	6	6	8	680
	150	60	150	320	
[Steel, rectangle, hand pushed, rubber, randomly, squared]	5	7	5	3	440
	125	70	125	120	
[Plastic, rectangle, hand pushed, rubber, randomly, squared]	3	7	6	3	415
	75	70	150	120	
[Steel, normal shape, hand pushed, thermoplastic rubber, equally distanced, triangular]	7	6	6	3	505
	175	60	150	120	

# Ratings

Scenario #3 (safe)	Durability	Easily used and maintained	Safe to use	Products organization	Score
Weight	30	15	40	15	730
[aluminum, normal shape, hand pushed, thermoplastic rubber, Half big, half small, rectangular]	8	5	7	9	
	240	75	280	135	
[ plastic, normal shape, hand pushed, thermoplastic rubber, equally distanced, rectangular]	6	6	6	8	630
	180	90	240	120	
[Steel, rectangle, hand pushed, rubber, randomly, squared]	5	7	5	3	500
	150	105	200	45	
[Plastic, rectangle, hand pushed, rubber, randomly, squared]	3	7	6	3	480
	90	105	240	45	
[Steel, normal shape, hand pushed, thermoplastic rubber, equally distanced, triangular]	7	6	6	3	585
	210	90	240	45	

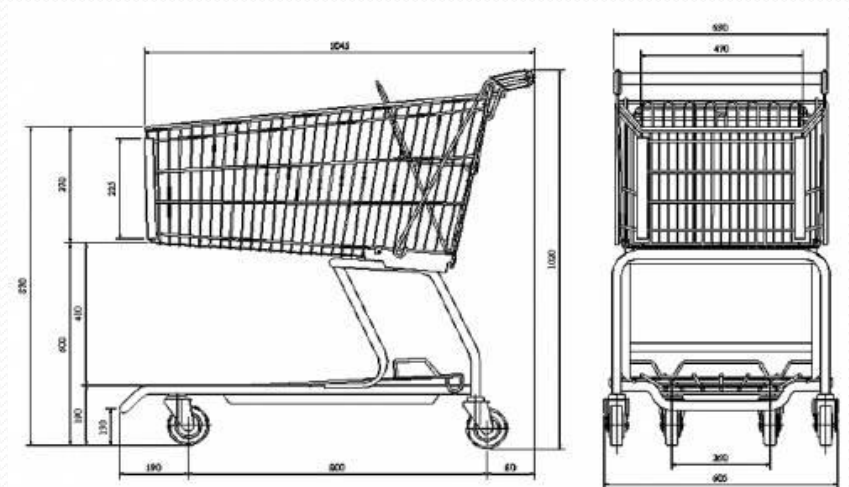
# Best Design

Design 1(aluminum, normal shape, hand pushed, thermoplastic rubber, Half big, half small, rectangular) is the best in all three scenarios making it the **optimum** design that we'll choose.

# Human factors

## ❖ Anthropometric factors:

- The height of an adult ranging from 150-190cm(Avg: 170)
- Height of the cart's handle around 1 m
- Arm's length ranges from 50-80 cm
- Hand grip size 9-16 cm
- Depth of the cart 55 cm





## ❖ Ergonomic factors

- Wheels' unlock by pushing the handle downwards moving (as the average shopper hands are usually on handle).
- Shoppers' average walking speed is 4.8km/h (adjust the movement to match their speed)
- Tires swivel to all directions to be easy in movement (to have lower exerted force)

## ❖ Physiological Factors:

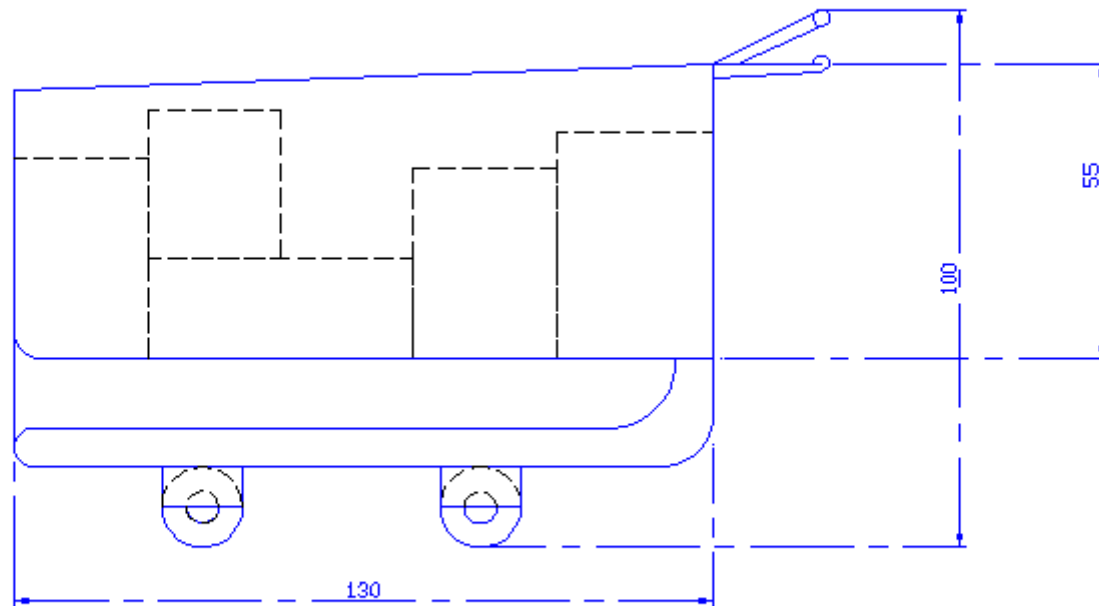
- Auditory:
  - The noise of the movement of wheels must not exceed 35 dB.
- Tactile:
  - The handle's material must be easy on hand's skin.
  - The cart's material should be comfortable for hands.

## ❖ Psychological Factors:

- The cart's colors should be pleasant to the sight (relaxing color).
- Different colors for the cart's parts, for classification.



# Design



# Conclusion

In conclusion, it was proven the importance of designing this project as was emphasized. This project will enhance the organization and safety of the products in a shopping cart, also the well being of humans and thus, will enhance the mood of people while shopping. All of the features of this project was calculated and evaluated accurately. Everything starting from the needs to the constraints to the criteria to the project's objectives was clearly stated. Different designs were generated from the needs, followed by a series of eliminations until five best designs were extracted. Then, based on the criteria that were set, rating was done until the most optimum design was figure and thus, created. This product should be successful and help better the shopping process. If any defects were to be figured later, developments to the cart will immediately be done.

**Thank you for your  
concentration**

**Any questions?**