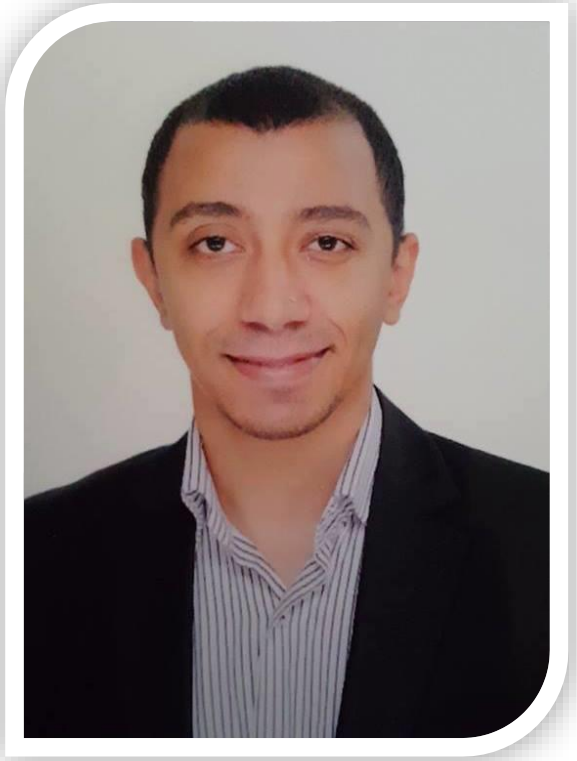
Information Technology Institute
Civil Engineering Informatics Track
Intake 37

Sort IT 4D

3D Load Planning, Visualization & Optimization Software

Our Team..



Mohamed Anas

Alaa EzelDeen

Agenda ...

Logical Problem

- Bussiness Case Study...
- Logical Problem..
- Probosal Solution..
- Approach..

Technical...

- Tools...
- Technology...

User Manual...

Demo...

Reference...

Logical Problem...

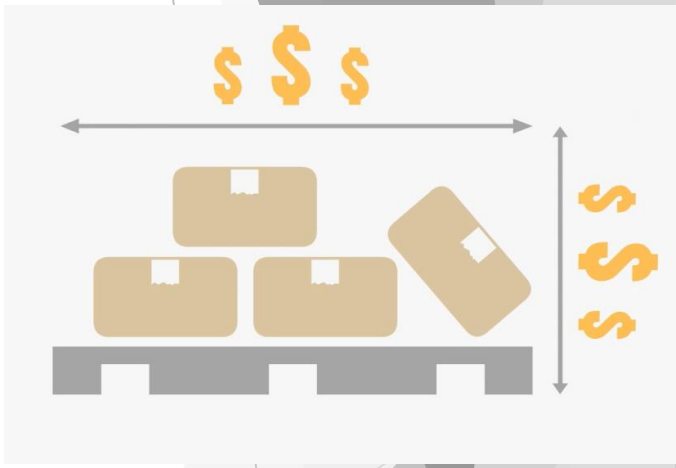
Bussiness Case Study...

Given n items of different weights and bins each of capacity c, assign each item to a bin such that number of total used bins is minimized. It may be assumed that all items have weights smaller than bin capacity

Essentially, the problem is trying to pack multiple items into multiple boxes in the optimum way, so they don’t overlap, to reduce the number of boxes needed and to simulate how a human would pack the items.

Logical Problem..

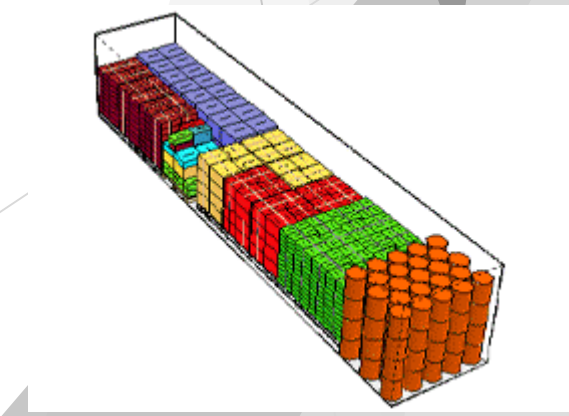
- Losing money while using online shop shipping company.



- Squander time and effort using human experience trying to sort items.

- Stacked items left ‘gaps’ in the box and unnecessary item cost you money.

- objects of different volumes must be packed into a finite number of bins or containers each of volume in a way that minimizes the number of bins used.



Users..

- Ware Houses.

- Shipping Companies.

Probosal Solution..

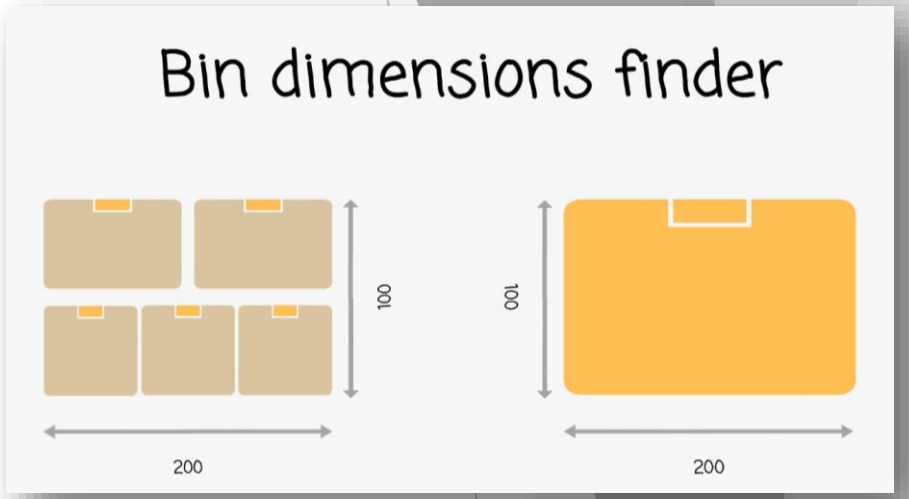
- Easy to use
- Platform independant
- High quality & high performance
- Timeline visualization

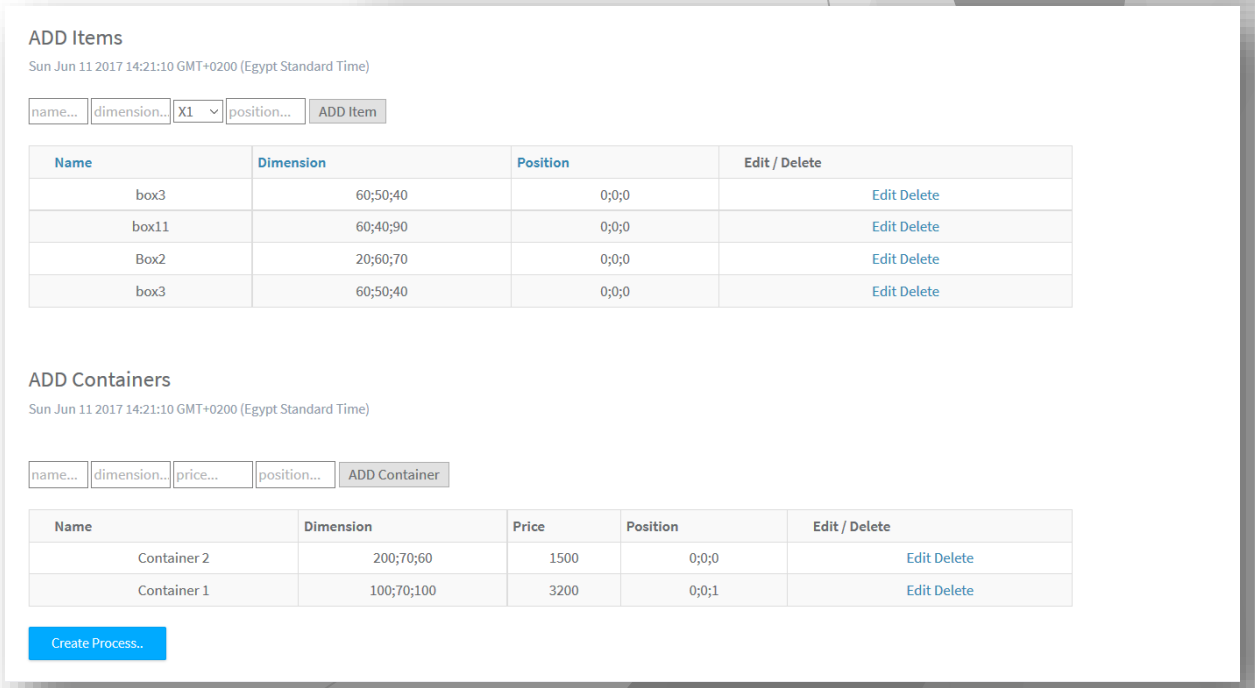
Approach..

- Brackets can define it’s dimensions to know how items can be sorted in it.

- Analyze the Dimension of each item and Container in the process

- Which items can fit in a container and reach the optimum utilization.





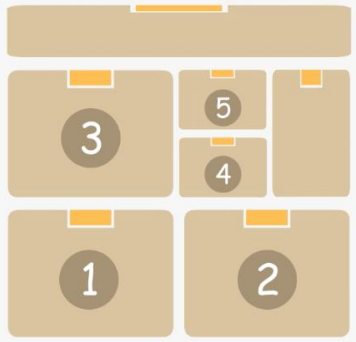
Approach..

- Work in parlell processing to reach the best algorithm for every case in a short time.

- Make a schedule to input and output the items from the container

- Sort the items perpendicular to the volume, count and price of each container.

- Dfine items once and use it many.



Technical...

Tools...

Microsoft ASP.net™

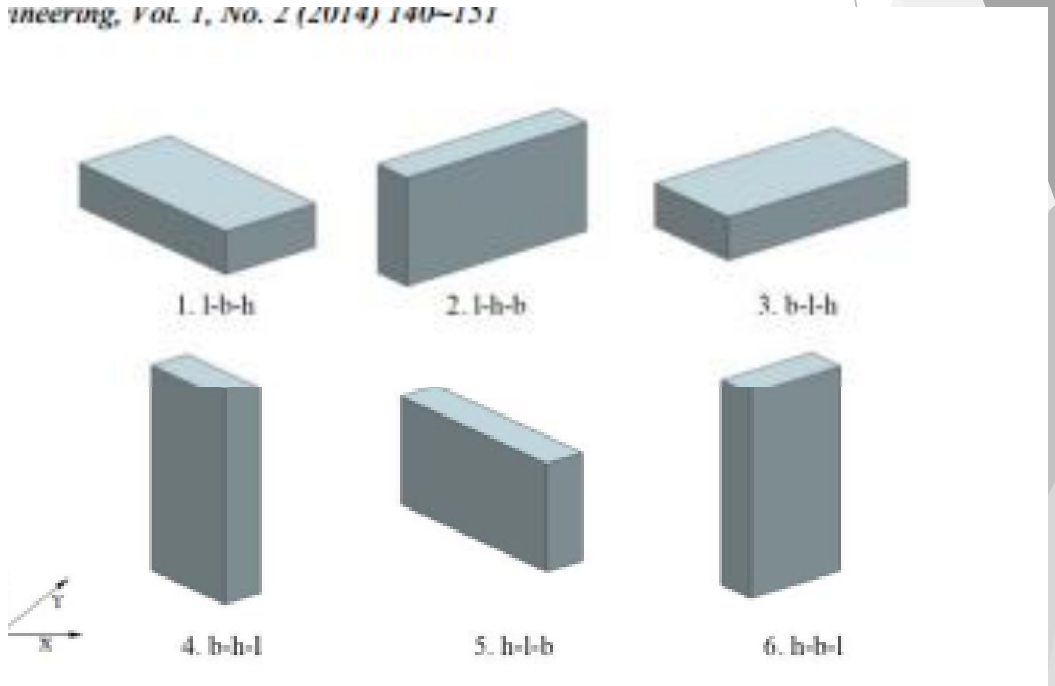
WebGL

Technology...

Paper”Three Dimensional Bin Packing Problem withVariable Bin Height”

1- Representation

The GA ‘Genetic Algorithm’ needs to consider two factors: the order of cartons to be packed and the carton rotation positions. All cartons are first sorted in volumetric descending order and numbered.

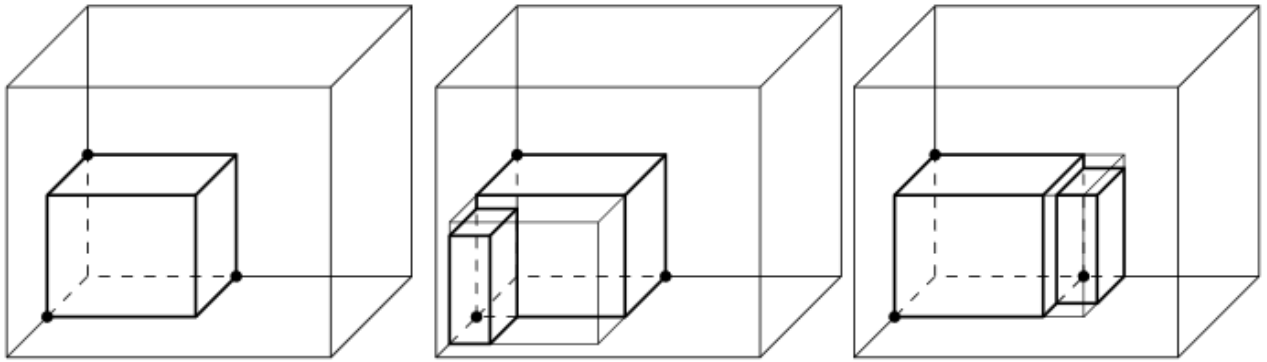


Technology...

Paper”Three Dimensional Bin Packing Problem withVariable Bin Height”

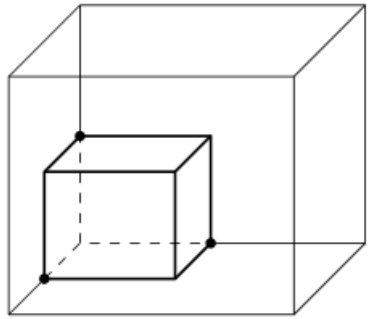
3- Fitness evaluation

After a carton has been placed into position, the left-front-bottom, rightbehind-bottom and left-behind-top points are treated as extreme points as shown as bold dots



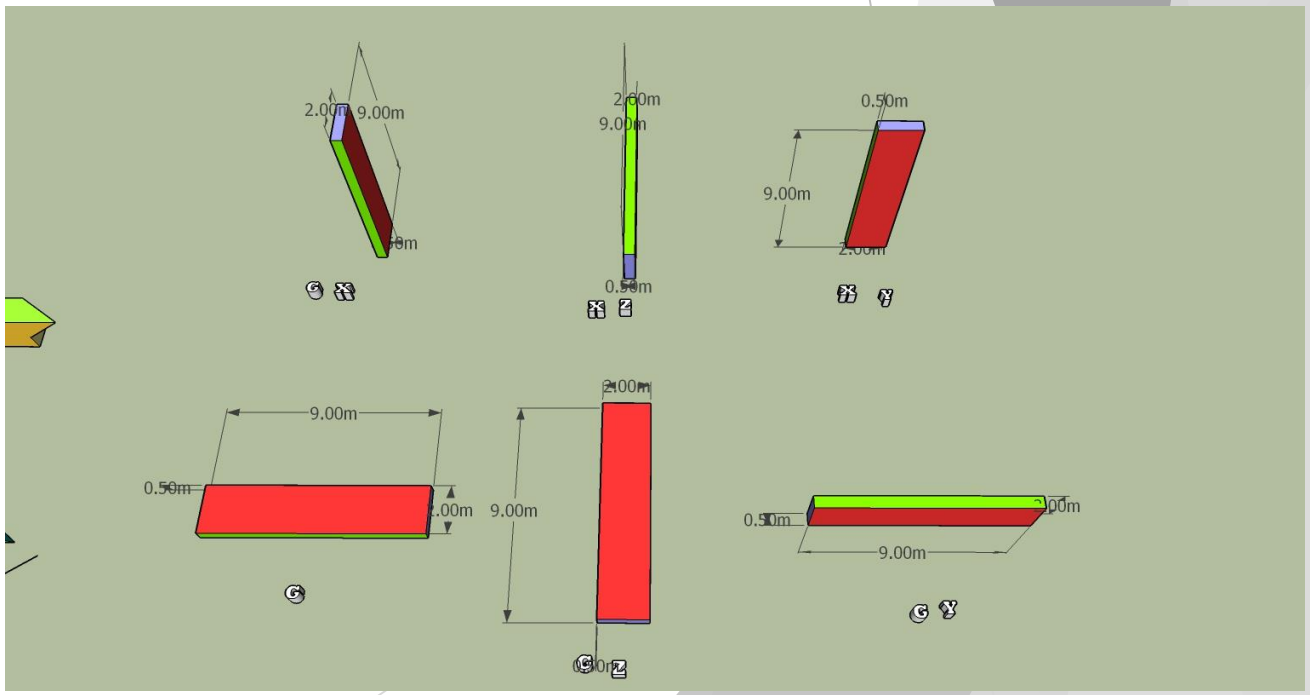
Technology...

“SORT IT 4D” Techniqe



First Item

- Start from 0,0,0 position.
- Choose biggest item fit in the container.
- If there is item doesn’t fit at anny container the software neglect it.

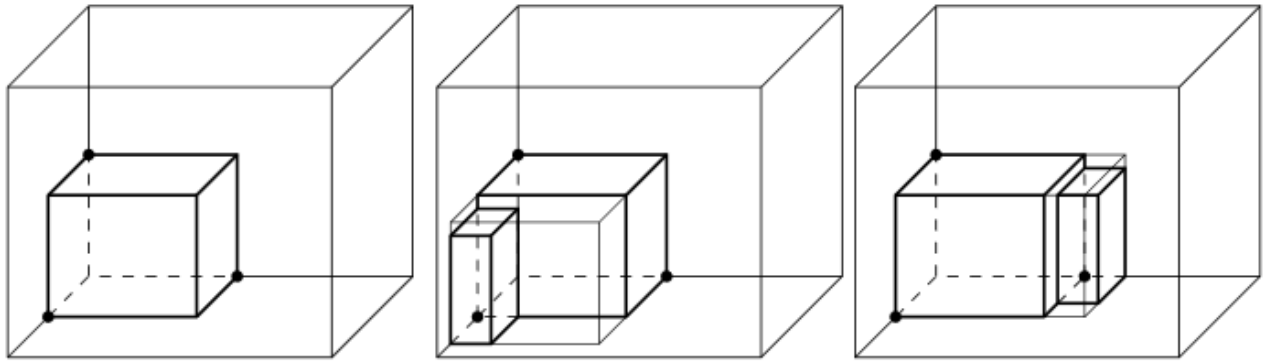


Technology...

"SORT IT 4D" Techniqe

Next Items

- The next item try one of three position
- Choose the start point to next container in the XY level .
- When box2 assigned in point with box1, in next step box 1 check in 2 points only.
- If the box volume larger than the free space in the container move to the other container.



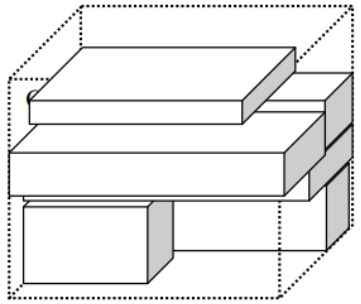


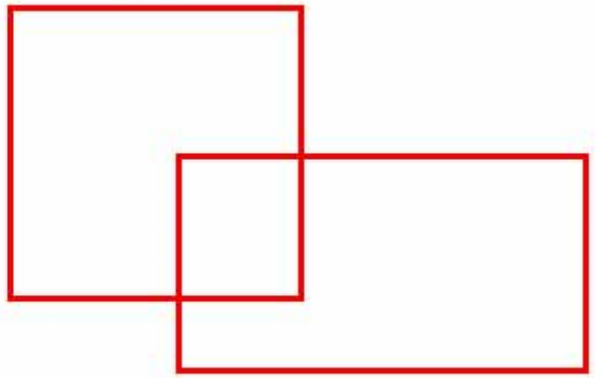
Fig. 3 A possible solution of the Algorithm.

Technology...

"SORT IT 4D" Techniqe

Collision Detection

- Made our own function to detect collision detection between items.
- Another validation function to make sure that the box is fully inside the container.



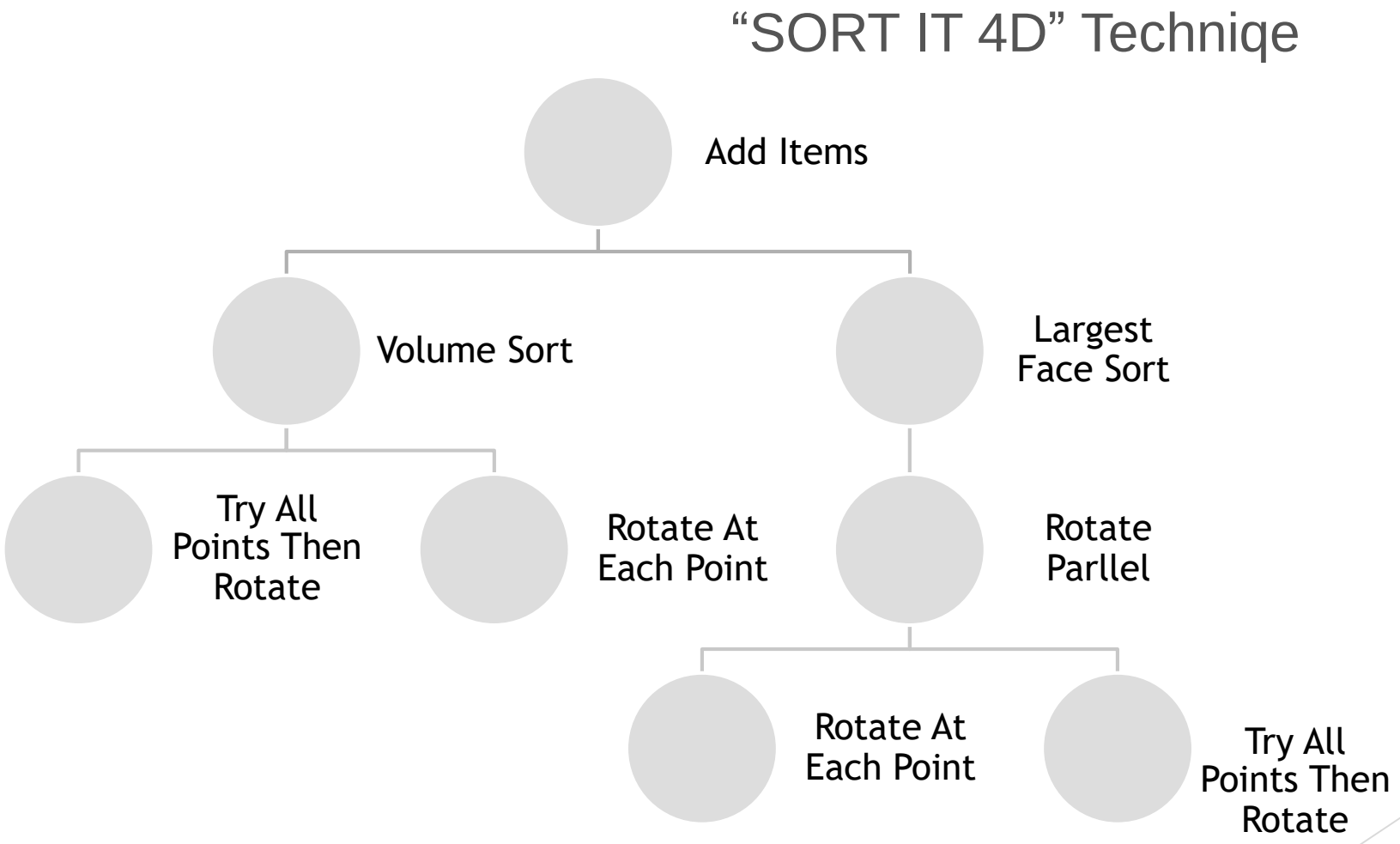
Technology...

"SORT IT 4D" Techniqe

Next Items

- No matter the order of entring the dimension, it will sort it by make the longest dim. In parellel.
- Choose the containers according to the price & volume.
- The software run multiple algorithms in parllel to reach the optimum solution.

Technology...


"SORT IT 4D" Techniqe
Add Items
Volume Sort
Largest Face Sort
Try All Points Then Rotate
Rotate At Each Point
Rotate Parllel
Rotate At Each Point
Try All Points Then Rotate

Technology...

"SORT IT 4D" Techniqe

Price Optimization

- Containers are sorted by volume.
- First we look for the container the container can takes biggest number of boxes.
- Then we check if the another container can take the same items with less price.
- Recursive function that makes each container reach down for cheaper containers to find if there are other possibilities to take same items with less total price.

Potentials...

- User can define different containers.
- Boxes can be rotated.
- Cost optimization.
- Timeline visualizations.
- Multi threading

User Manual...

Software Design...

Easy to use

Just click the “Add item” button, insert dimensions, name and the rotation item will appear in gridview table conected with database

ADD Items

Sun Jun 11 2017 14:21:10 GMT+0200 (Egypt Standard Time)

name... dimension... X1 position... ADD Item

Name	Dimension	Position	Edit / Delete
box3	60;50;40	0;0;0	Edit Delete
box11	60;40;90	0;0;0	Edit Delete
Box2	20;60;70	0;0;0	Edit Delete
box3	60;50;40	0;0;0	Edit Delete

Software Design...

Easy to use

Now click the “Add Container” button, insert dimensions, name and the price of container ➔ to make a process click the “ create process” button.

ADD Containers

Sun Jun 11 2017 14:21:10 GMT+0200 (Egypt Standard Time)

name... dimension... price... position... ADD Container

Name	Dimension	Price	Position	Edit / Delete
Container 2	200;70;60	1500	0;0;0	Edit Delete
Container 1	100;70;100	3200	0;0;1	Edit Delete

Create Process..

Software Design...

Easy to use

- Process page enable you to choose specific items and containers and the count of each one.
- Process name, date and items details automatic save in DB.

Process Details

Name Your Process..

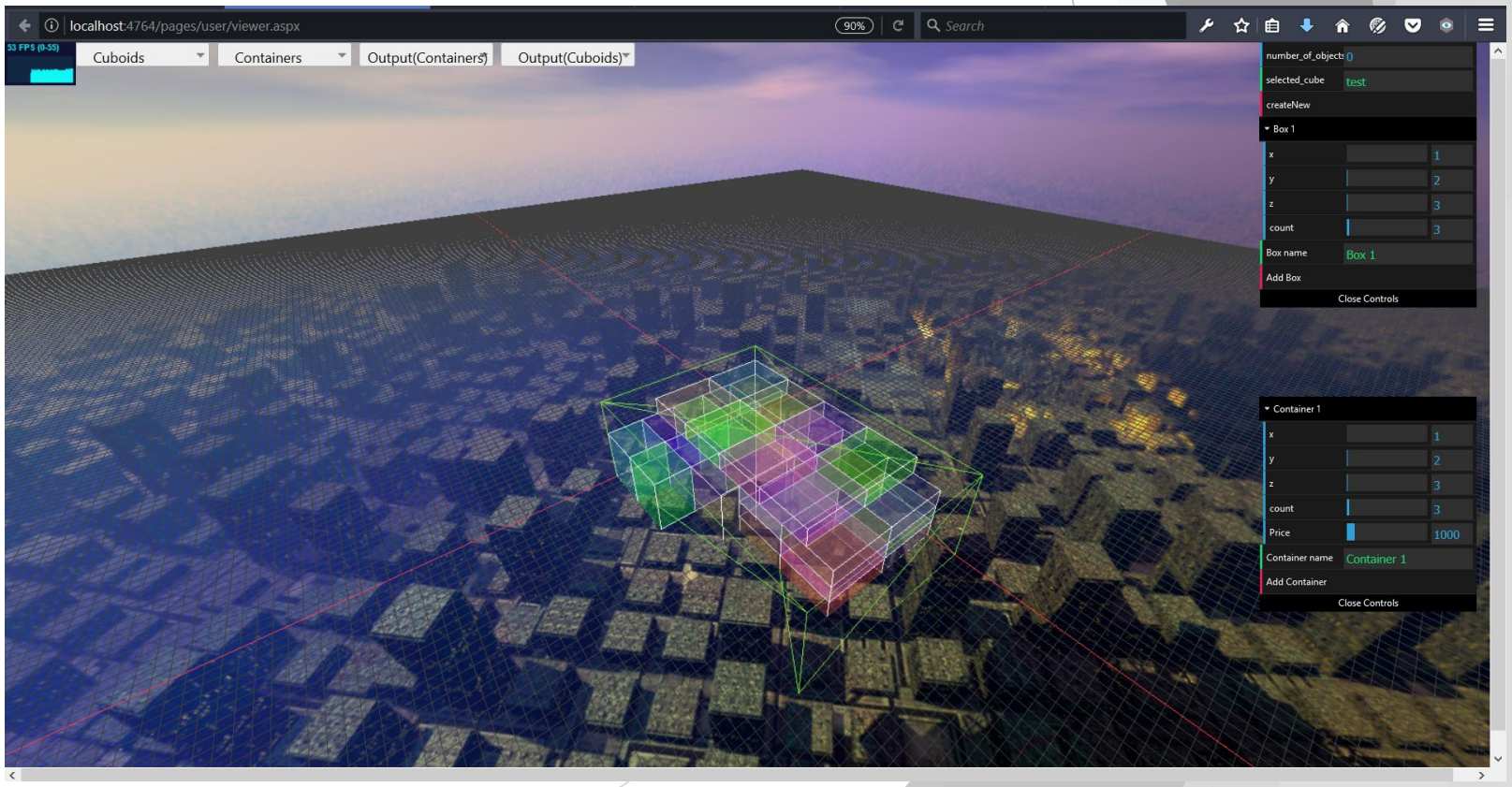
Mon Jun 12 2017 13:56:36 GMT+0200 (Egypt Standard Time)

Select	Count	Name	Dimension
☐		box3	60;50;40
☐		box11	60;40;90
☐		Box2	20;60;70
☐		box3	60;50;40

Software Design...

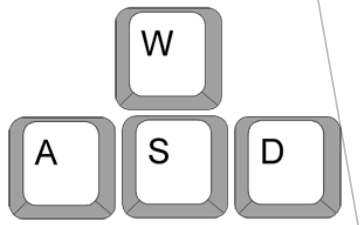
Easy to use

3D viewer enable to you to choose item and show the full details on it.

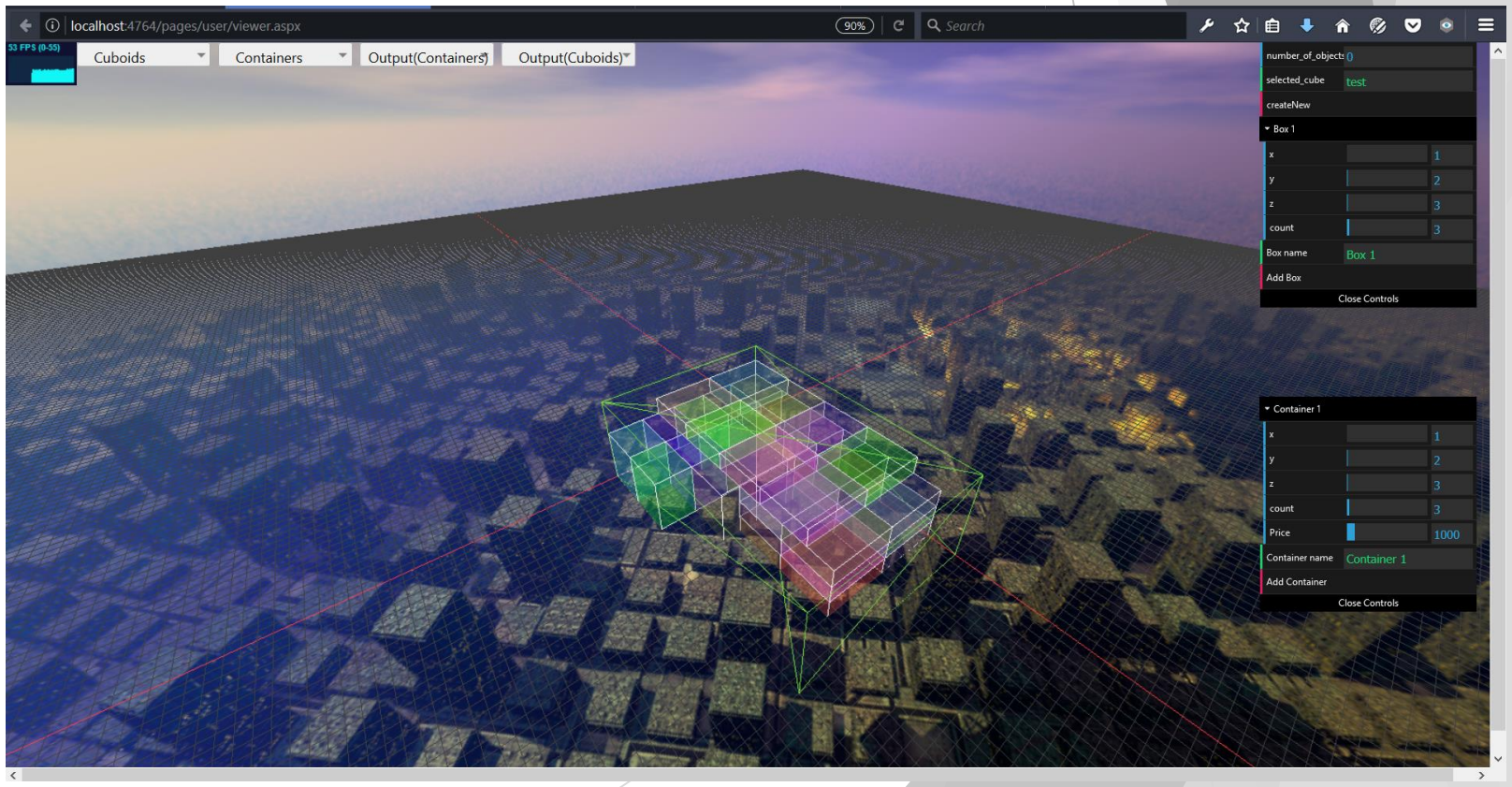


Software Design...

Easy to use



“wasd” keys enable user to move between items and containers.

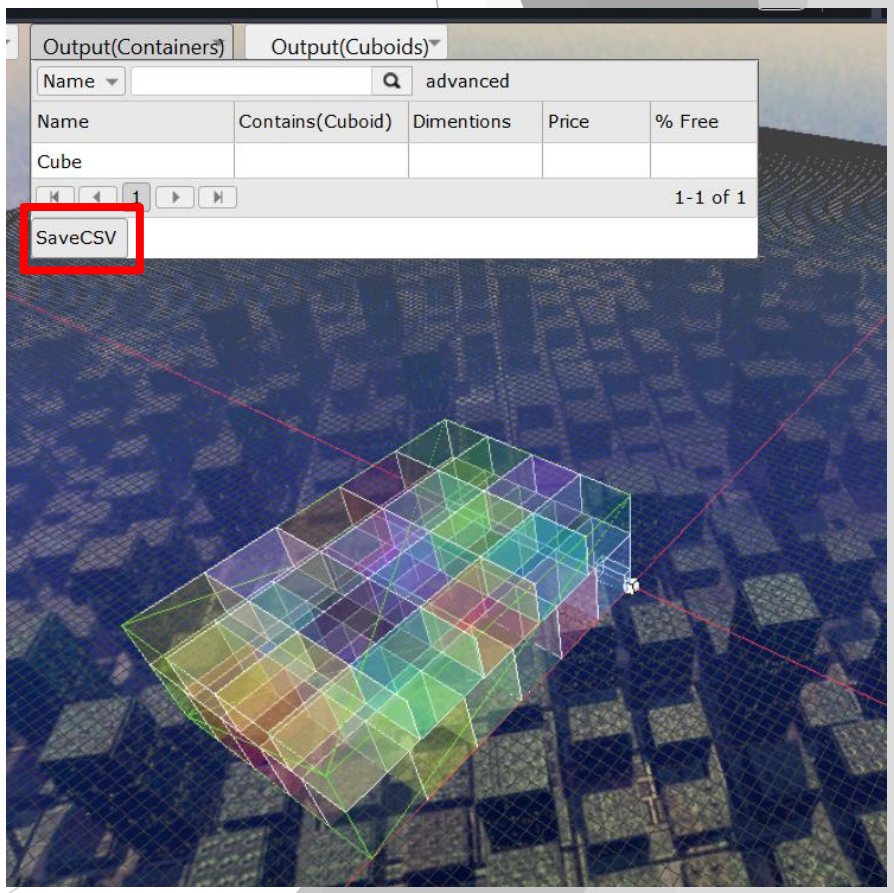


Software Design...

Save space and time

- The whole evaluation process is finished within a minute.

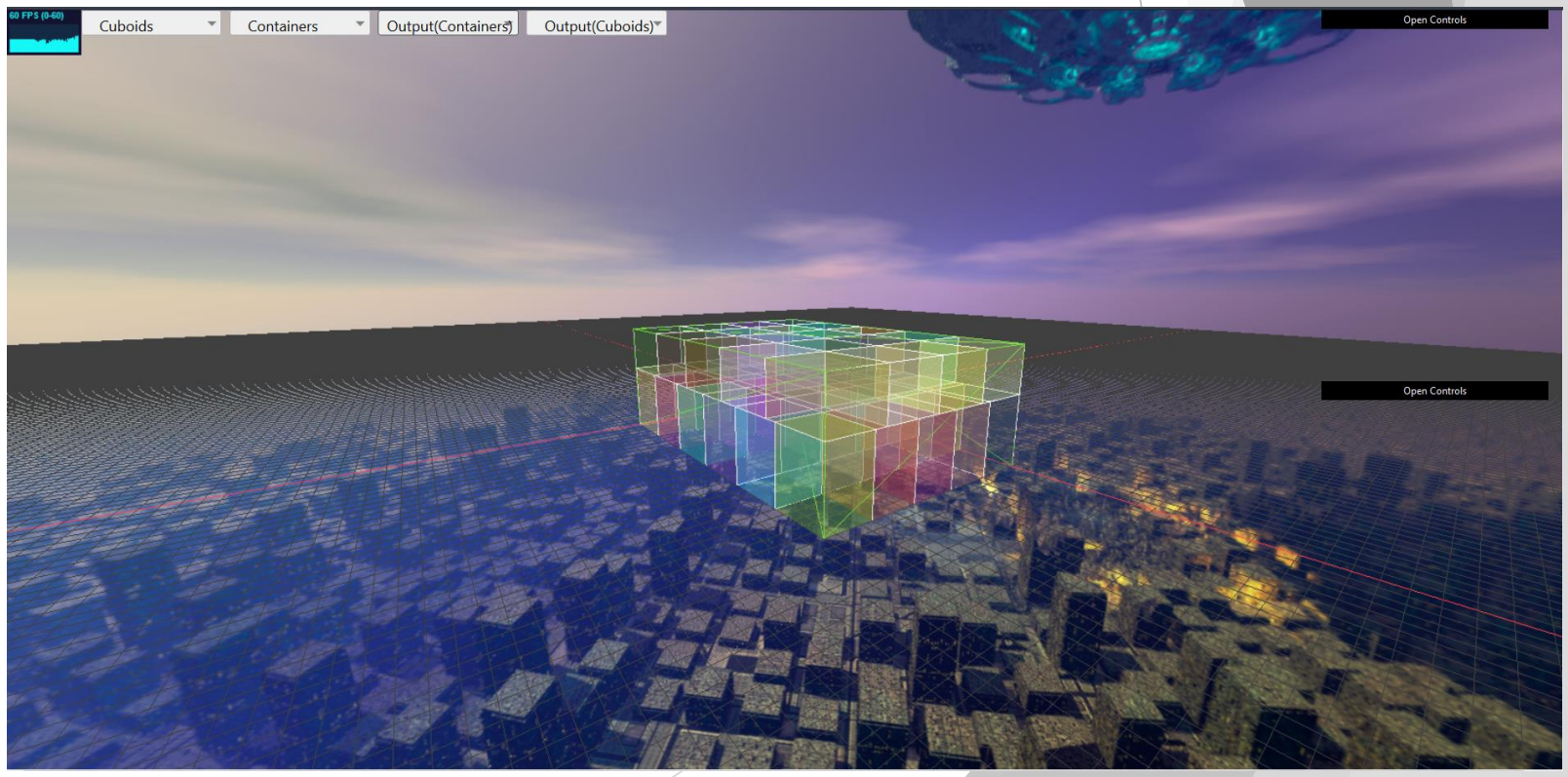
- You can then examine the load plan result and generate a print report, which can be printed or shared.



Software Design...

Best visualization

The entire load plan result is shown in interactive 3D, just like in a game. You can rotate or zoom to explore details of your load plan.



Competitors...

Another Softwares

- Desktop application

- No Rotations avaliable

packit4me(v2.0)

- Algorithm only fit in boxes

- Mistakes in sorting algorithms

Sort IT 4D

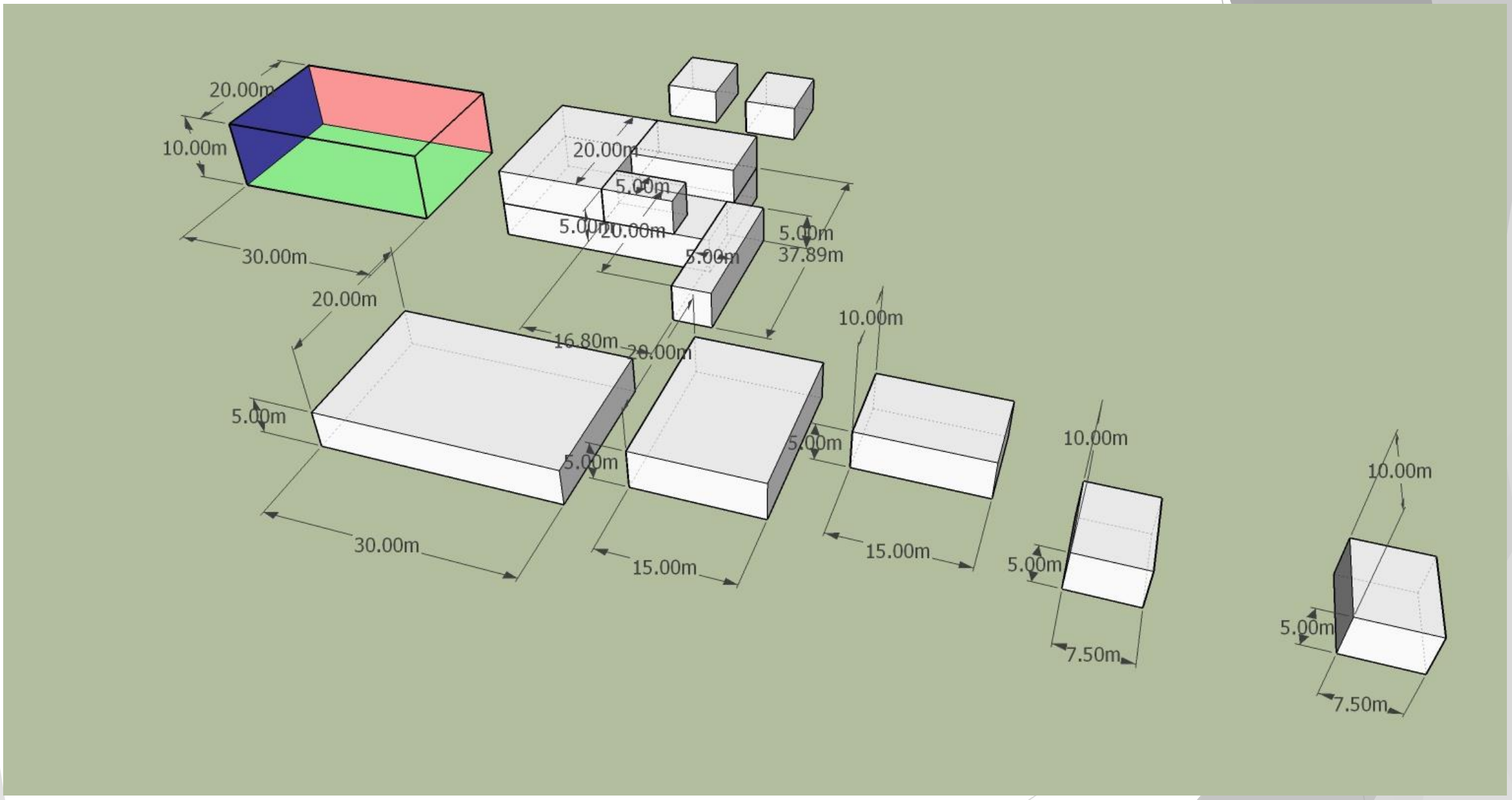
- Web pased application

- Try rotations in 6 dimensions

- Many algorithms run in parellel

- Define new items-irregular shapes- and stack them together.

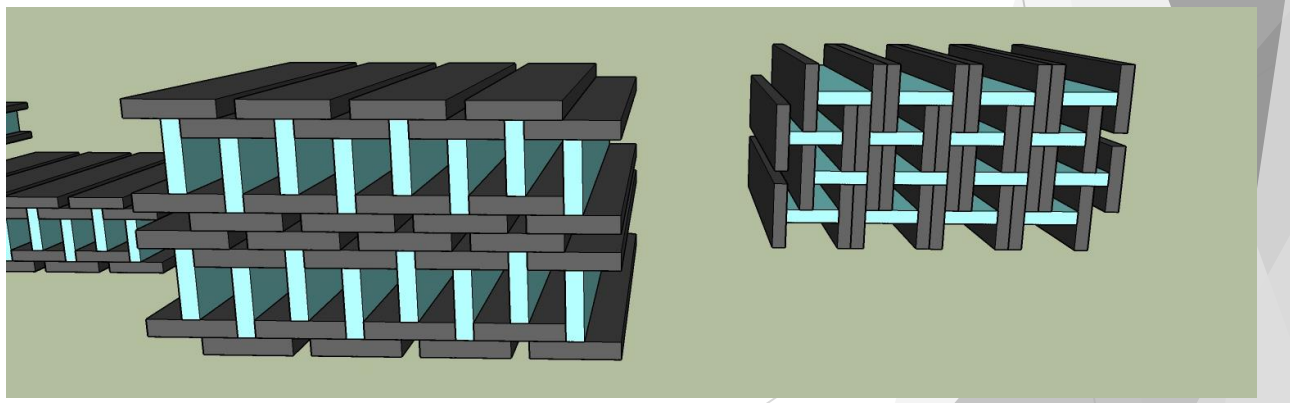
Demo...


20.00m
10.00m
30.00m
20.00m
20.00m
5.00m
5.00m
20.00m
5.00m
5.00m
37.89m
16.80m
20.00m
10.00m
5.00m
5.00m
5.00m
30.00m
15.00m
15.00m
10.00m
5.00m
7.50m
10.00m
5.00m
7.50m

Future Plan...

- Using grouping method to stack irrgular shapes ‘steel shapes’.
- Can add any algorithms in the future time.

Figure 11. Comparison between 1st part’s 1st posture, and 2nd part’s 1st~6th postures.



Reference...

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- M.Zahid Gürbüz, Selim Akyokuş, İbrahim Emiroğlu, Aysun Güran; An Efficient Algorithm for 3D Rectangular Box Packing; Published by the Society for ETAI of Republic of Macedonia, Skopje, 2009

- Wissam FAYSAL Maarouf, Aziz M.Barbar,Michel Owejan; A New Heuristic Algorithm for the 3D Bin Packing Problem; Chapter · August 2008.

- Erhan BALTACIOGLU, B.S; THE DISTRIBUTER'S THREE-DIMENSIONAL PALLET-PACKING PROBLEM: A HUMAN INTELLIGENCE-BASED HEURISTIC APPROACH; March 2001.


Thank
You