A tricycle for amputed children

Americas by design

Summary

- The choice of requirements
- Product function
  - Function tree
  - System functionnalty
- Design specification
- Patent search and benchmarking
- Solution chosen

The choice of requirements « Needs »

To be ridable with muscles for a one leg amputed child (3-5 years)

- To carry the amputed child
- To move the amputed child
- To be usable with low force
- To be easy to climb on the saddle

To be safe for the child

- To be stable
- To have a parental control system
- To have brakes

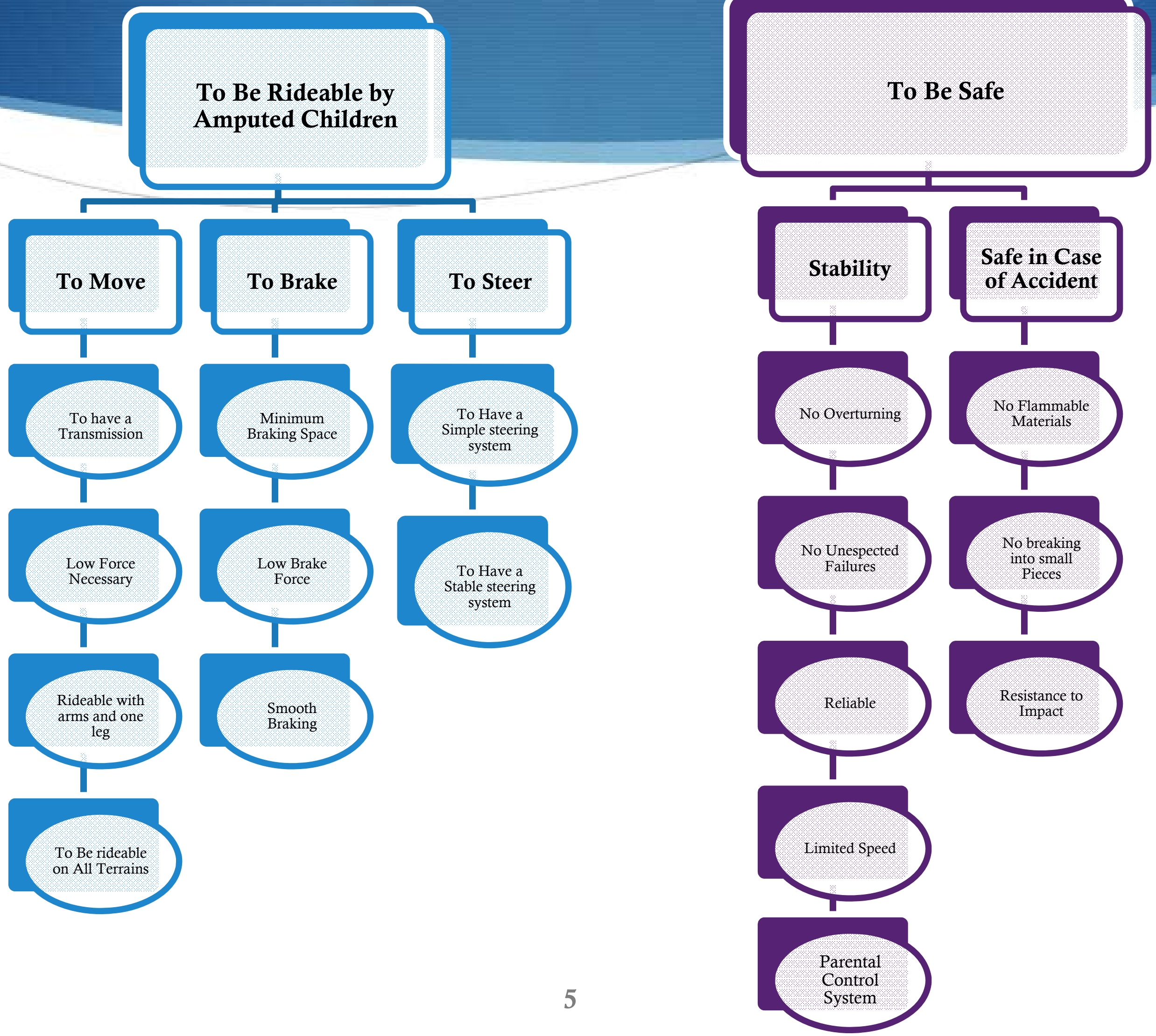
To be ergonomic

- To have a driving movement cloth to a classic bike
- To have adjustable saddle and handlebar

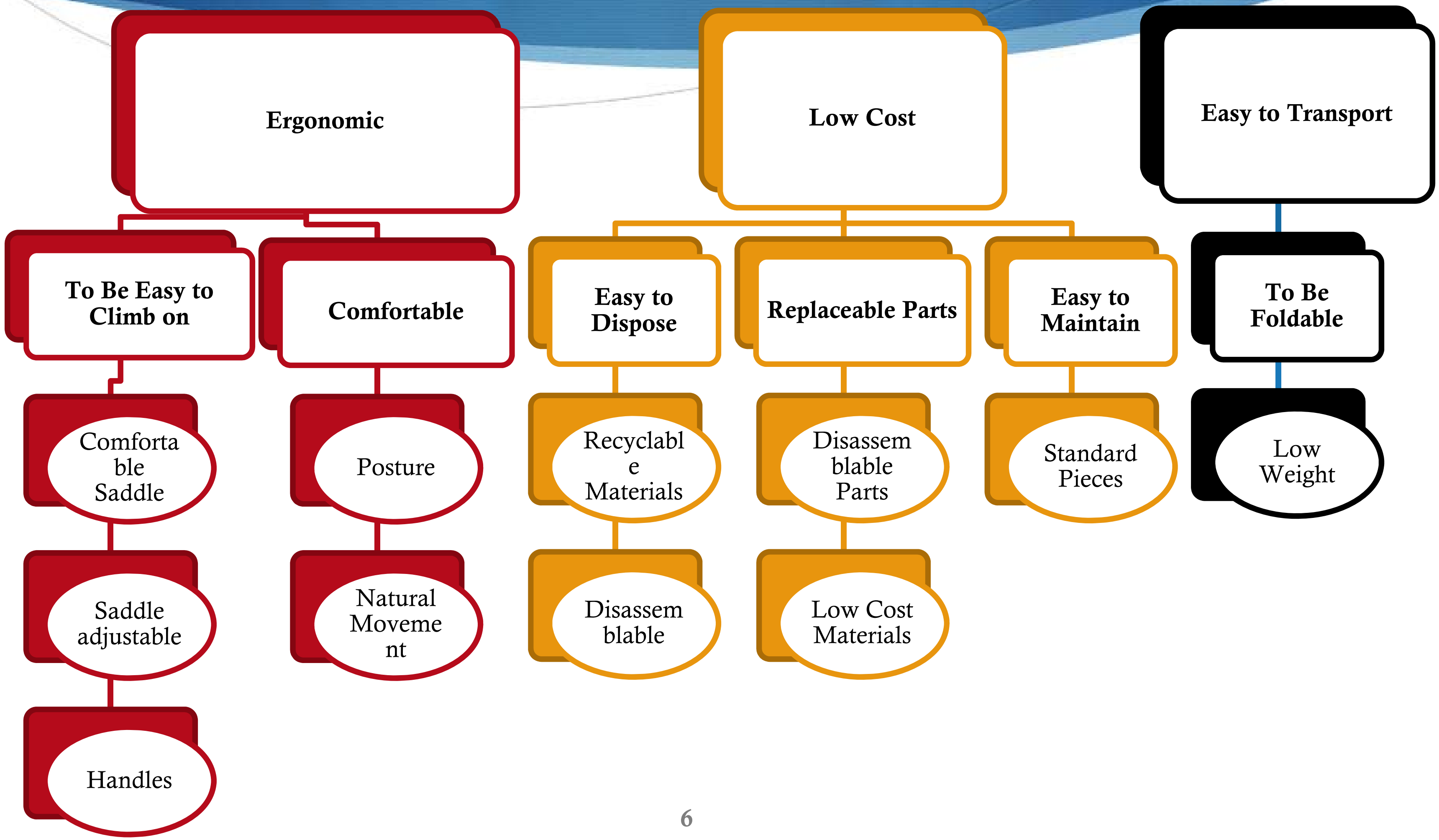
The choice of requirements « Wishes »

To be economic	To be easy to mantain	To be easy to transport	To be ridable on all terrain	Aesthetically pleasing bicycle
To use of low cost material	To have standard pieces	To be foldable	To have all terrain pneumatics	To shape similar to classic bikes
To have an efficient manufacturing program	Can be dismantled	To be Light	To resist to corrosion	
To use standard pieces				

Product Function (Function tree)

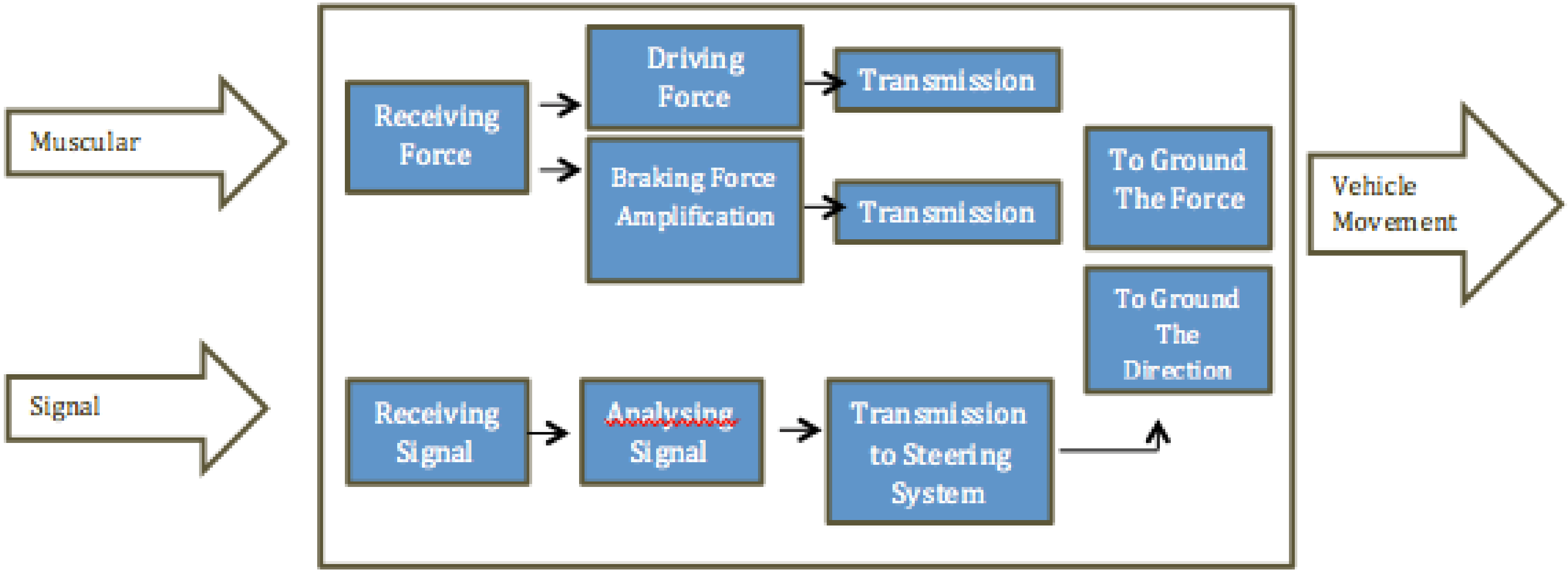


Function tree (next)



Product Function

System functionality



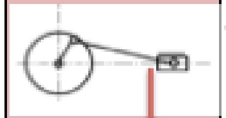
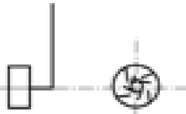
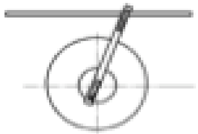
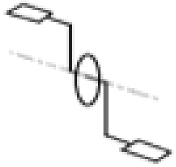
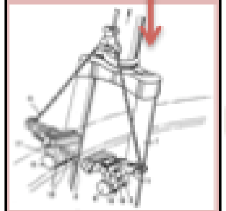
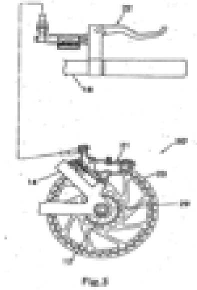
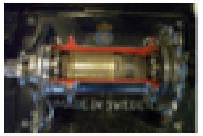
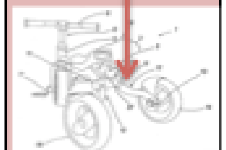
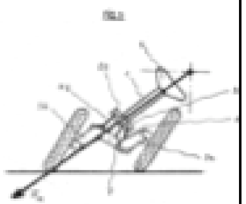
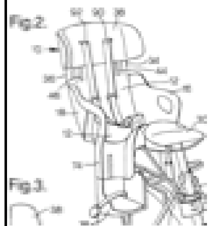
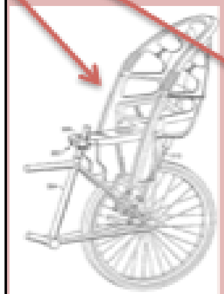
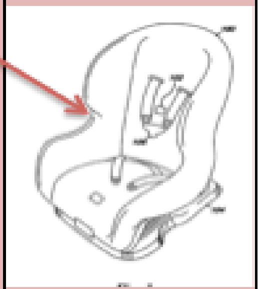
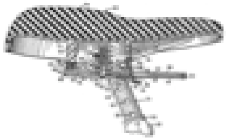
Design specification

Maximum Transportable Weight	**30 Kg**
Maximum Speed	20 km/h
Child between 60 cm and 130 cm tall	
Maximum tricycle weight	8,5 Kg
Maximum size when folded (Volume)	60 cm x 50 cm x 100 cm
Braking System Power	1 KW
Maximum Deceleration	3 m/s^2 (Stop time = 0,63s Braking Space = 2,93 m)
Gravity center as low as possible	
Corrosion resistant Material	
Recyclable Material	
Standard Wheels	
Maximum Steering Radius	2 m

Patent search and benchmarking

- MOVEMENT PRINCIPLES
- BREAKING SYSTEM SOLUTIONS
- DRIVING SYSTEM
- SADDLE

Solution chosen …

Movement principles					
Breaking system solutions					
Driving system					
Saddle					

… thanks to the Marks

- Choice of a pounderation for each requirements
- Each members give a mark
- Choice of the first two solutions

Requirement	R1	R2	R3	R4	R5	R6	R7	R8	Sum
Weight	5	5	4	2	3	2	1	3	
S1	**4.00**	**4.67**	**4.33**	**3.67**	**2.67**	**3.67**	**4.00**	**3.67**	**3.49333333333333**
S2	4.50	4.25	4.25	3.25	3.00	3.25	3.25	2.75	3.44
S3	3.75	4.42	4.58	3.42	3.17	3.67	4.25	3.42	3.48333333333333
S4	3.88	2.81	3.81	2.56	2.25	3.06	3.56	1.94	2.81
S5	3.69	4.35	4.40	3.35	2.54	3.92	3.81	3.10	3.35083333333333
S6	3.97	3.70	4.20	2.89	2.81	3.27	3.39	2.48	3.1725

AHP Method

- Determine the **<u>relative</u>** weights of the decision criteria
- Determine the **<u>relative</u>** rankings (priorities) of alternatives
- We didn't take the cost in consideration

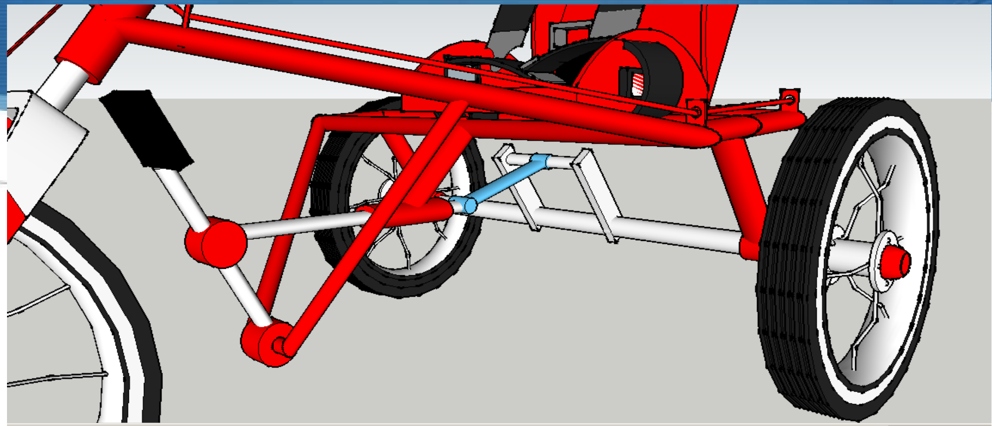
	safe	ergonomic	foldable	aesthetic	rideable
safe	1	2	4	6	0,5
ergonomic	0,5	1	3	5	0,33333
foldable	0,25	0,33333	1	2	0,2
aesthetically pleasing	0,16667	0,2	0,5	1	0,16667
rideable	2	0,2	5	6	1

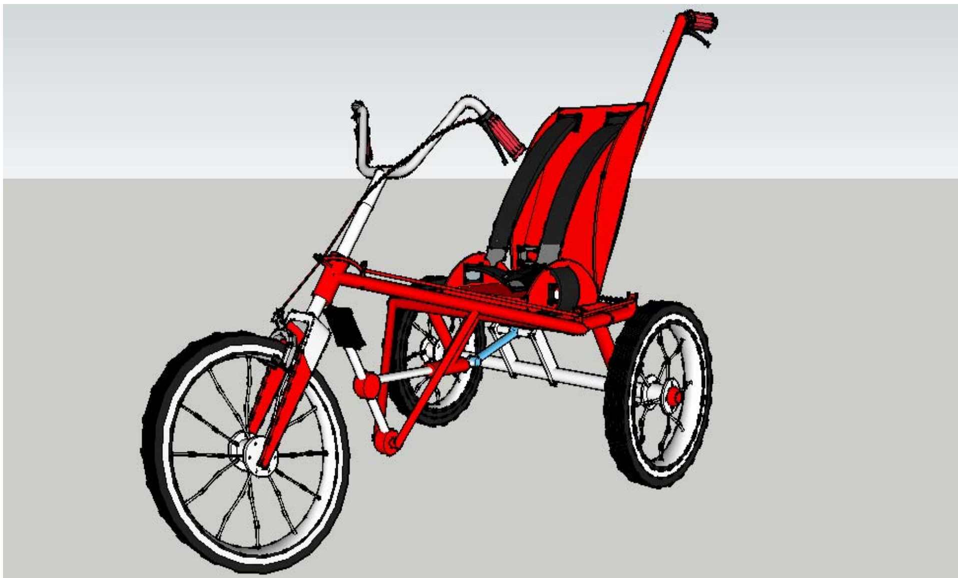
Before Costs	
S1	0,5739
S2	0,4261

```
% Matrix A is defined by selecting the relative weights of the decision criteria
(SAFE-ERGONOMIC-FOLDABLE-AESTETICALLY PLEASING-RIDEBLE BY AMPUTED CHILD)
%%

A=[1 2 4 6 0.5;0.5 1 3 5 1/3;0.25 1/3 1 2 0.2;1/6 0.2 0.5 1 1/6;2 0.2 5 6 1];
B=A^2;
vett=[sum(B(1,:));sum(B(2,:));sum(B(3,:));sum(B(4,:));sum(B(5,:))];

% The computed eigenvector gives us the relative ranking of our criteria
vett_norm=vett/sum(vett)

%% Now we procede in the same way by giving weights to our two possible solutions
according to each criteria

safe=[1 3;1/3 1];
ergonomic=[1 1;1 1];
foldable=[1 1/3;3 1];
aestetically=[1 4; 0.25 1];
rideble=[1 1;1 1];


% SAFE
safe_1=safe^2;
vetts=[sum(safe_1(1,:));sum(safe_1(2,:))];
vett_norms=vetts/sum(vetts)

% ERGONOMIC
ergonomic_1=ergonomic^2;
vette=[sum(ergonomic_1(1,:));sum(ergonomic_1(2,:))];
vett_norme=vette/sum(vette)

% FOLDABLE
foldable_1=foldable^2;
vettf=[sum(foldable_1(1,:));sum(foldable_1(2,:))];
vett_normf=vettf/sum(vettf)

% AESTETICALLY PLEASING
aestetically_1=aestetically^2;
vetta=[sum(aestetically_1(1,:));sum(aestetically_1(2,:))];
vett_norma=vetta/sum(vetta)

%RIDEBLE BY AMPUTED CHILD
rideble_1=rideble^2;
vettr=[sum(rideble(1,:));sum(rideble(2,:))];
vett_normr=vettr/sum(vettr)


% In matrix C there are weights of the single solutions according to our benefits
only(without considerations about costs)

C=[vett_norms vett_norme vett_normf vett_norma vett_normr];
D=C*vett_norm
```

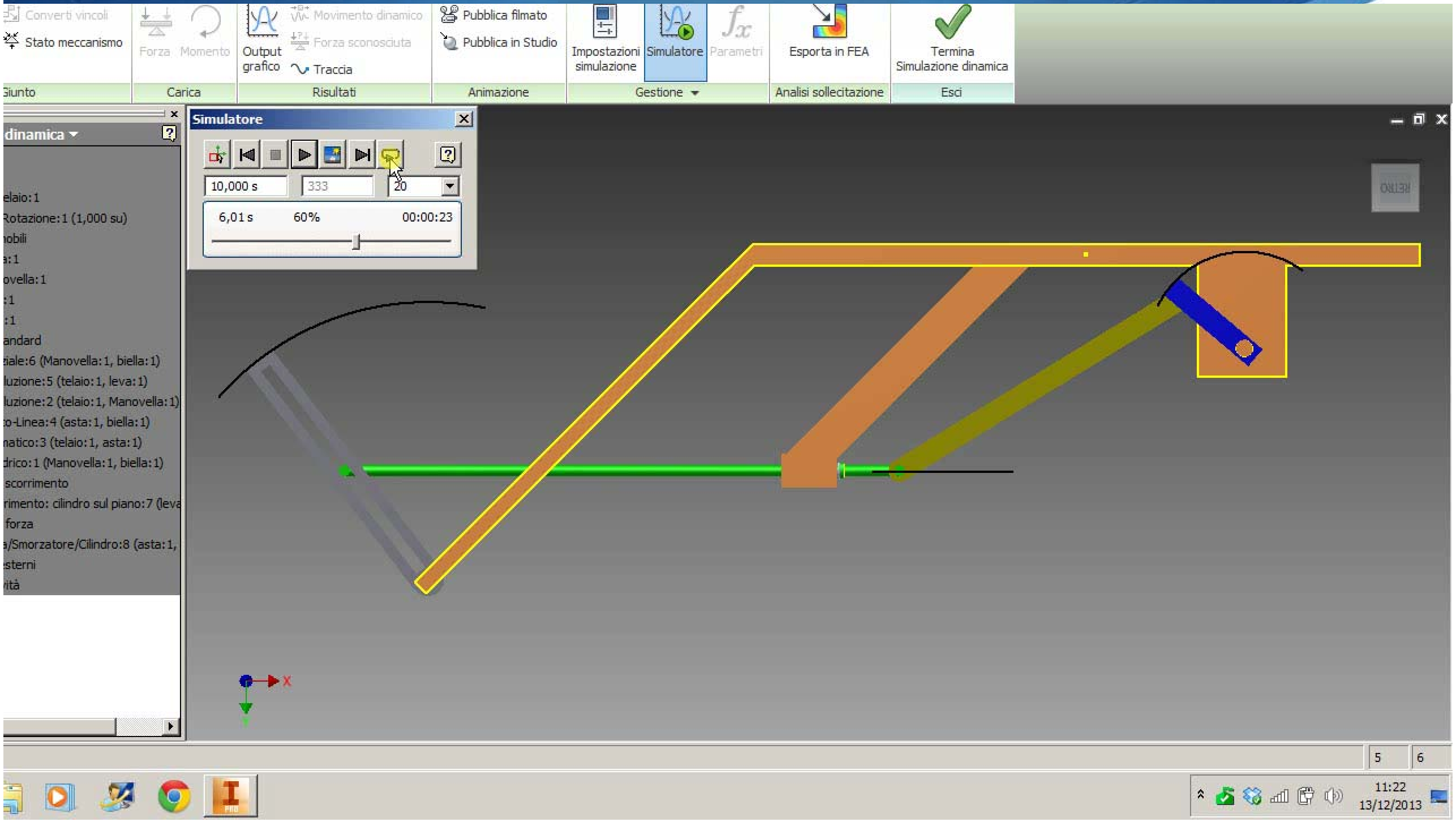
And the Winner is …!!!

Solution 1

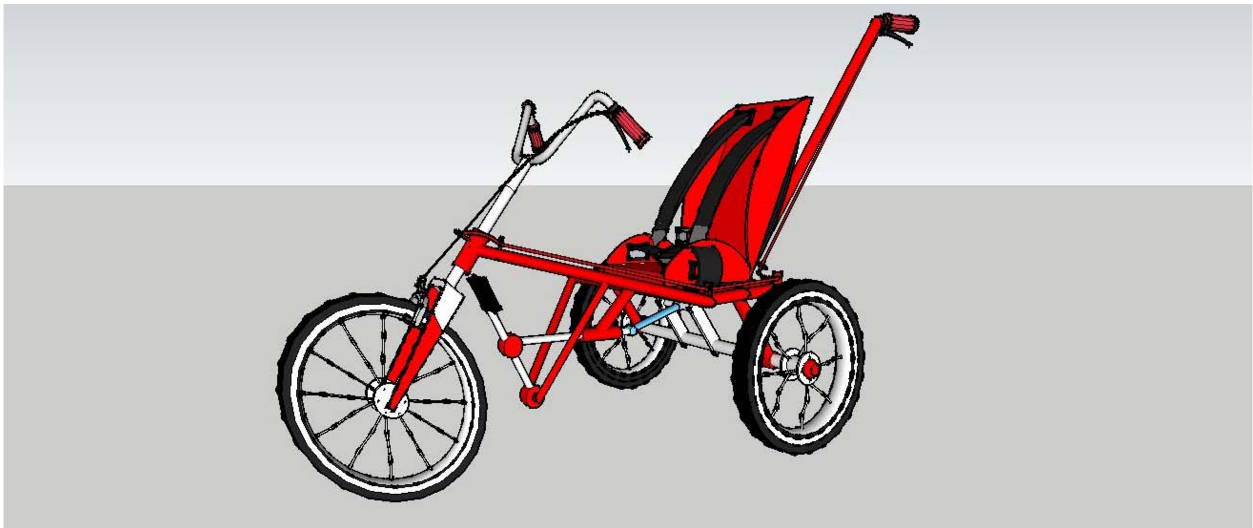




An innovative transmission solution



General view of design



Conclusion

- Maked us understand how to manage an innovative project
- Enabled us to meet students from south America and USA
- Understood the designers's different way of thinking

→ We now need an mechanical optimisation of the frame in order to minimize the weight