

A tricycle for amputated children

Americas by design



Summary

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

To be rideable
with muscles
for a one leg
amputated
child (3-5
years)

To carry the
amputated
child

To move the
amputated
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
« Needs »

The choice of requirements

« Wishes »

To be economic

To use of low cost material

To have an efficient manufacturing program

To use standard pieces

To be easy to mantain

To have standard pieces

Can be dismantled

To be easy to transport

To be foldable

To be Light

To be ridable on all terrain

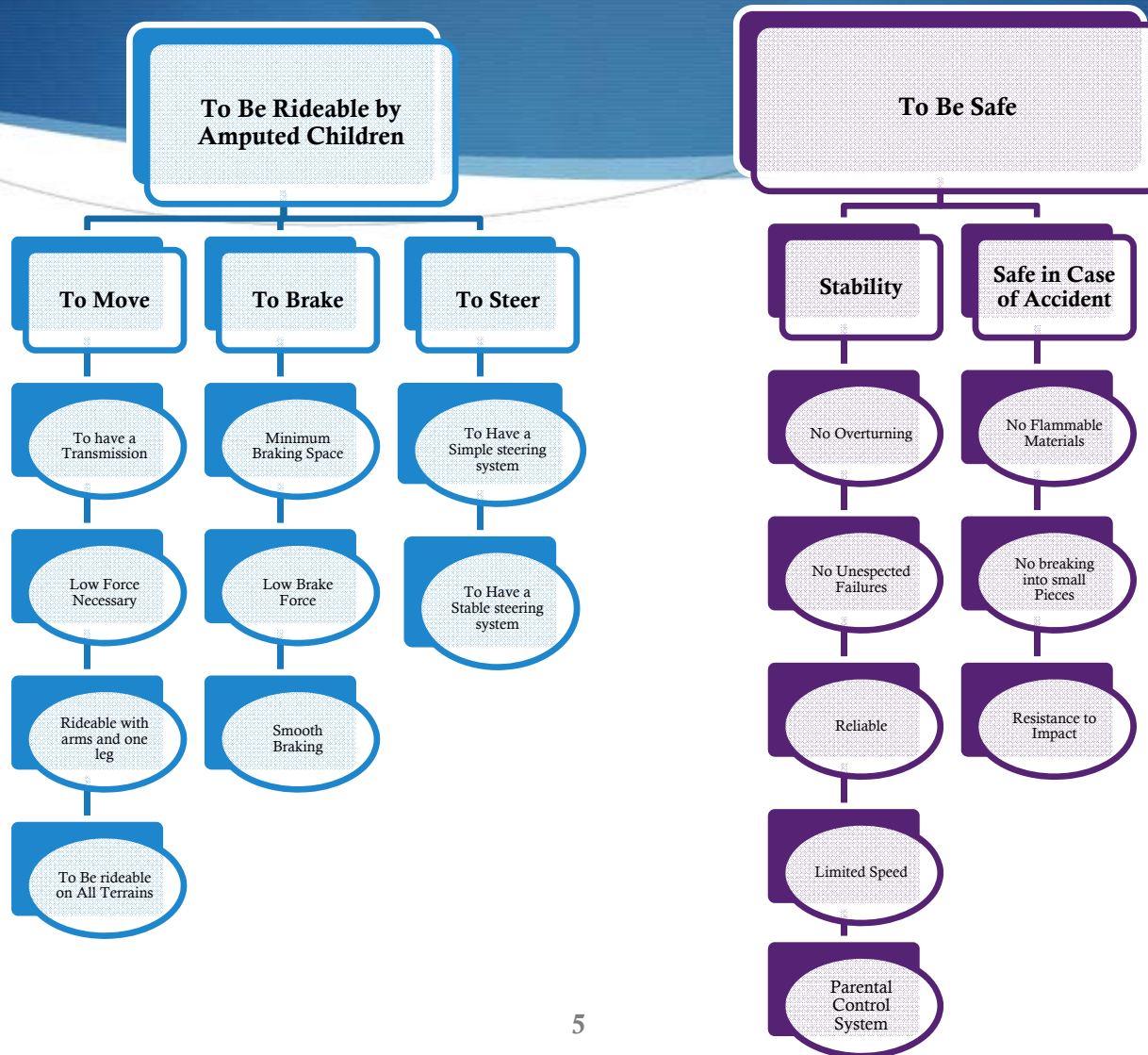
To have all terrain pneumatics

To resist to corrosion

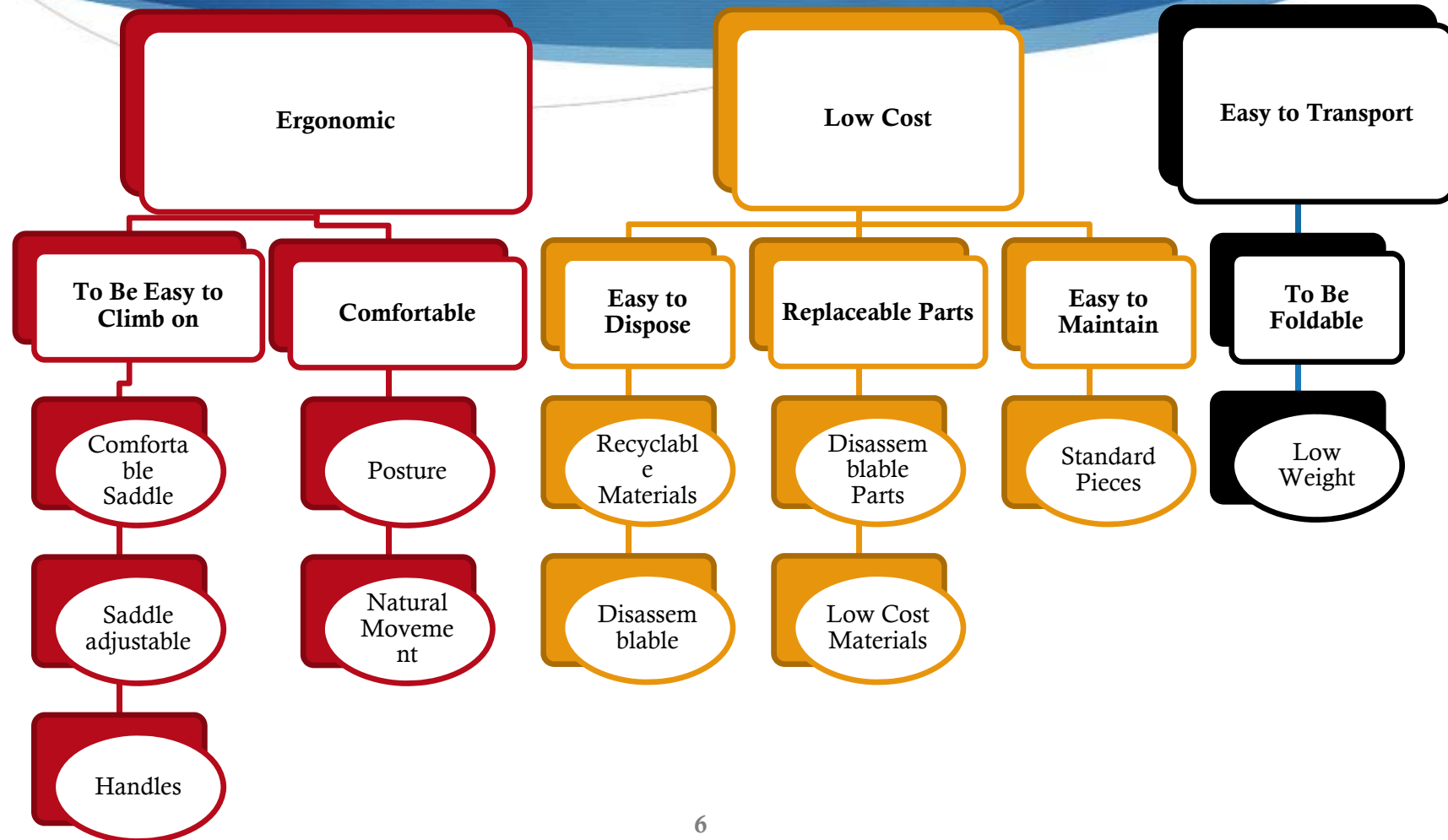
Aesthetically pleasing bicycle

To shape similar to classic bikes

Product Function (Function tree)

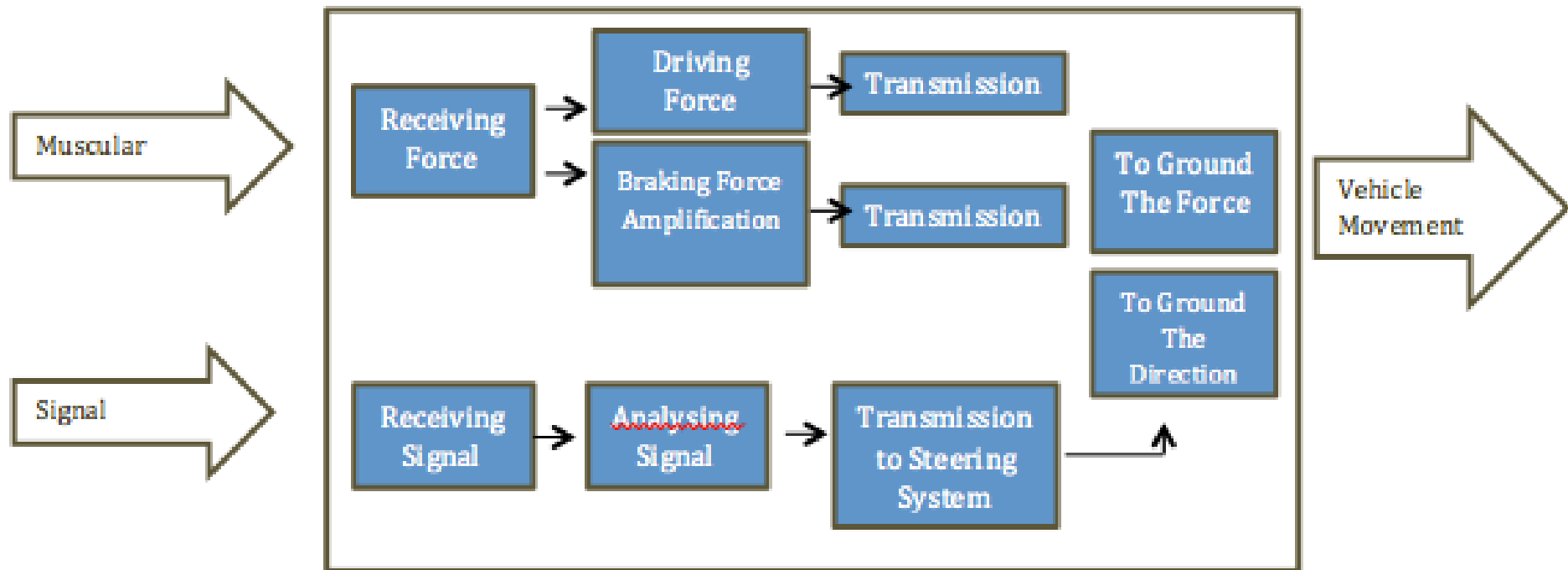


Function tree (next)



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

Movement principles					
Breaking system solutions					
Driving system					
Saddle					

Solution
chosen

...

... thanks to the Marks

- Choice of a ponderation 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	3.493333333333333
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	3.483333333333333
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	3.350833333333333
S6	3.97	3.70	4.20	2.89	2.81	3.27	3.39	2.48	3.1725

AHP Method

- 💧 Determine the relative weights of the decision criteria
- 💧 Determine the relative 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-AESTHETICALLY PLEASING-RIDEABLE 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);

%% How we proceed 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];
aesthetically=[1 4; 0.25 1];
rideable=[1 1;1 1];

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

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

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

% AESTHETICALLY PLEASING
aesthetically_1=aesthetically^2;
vettc=[sum(aesthetically_1(1,:));sum(aesthetically_1(2,:))];
vett_norms=vettc/sum(vettc);

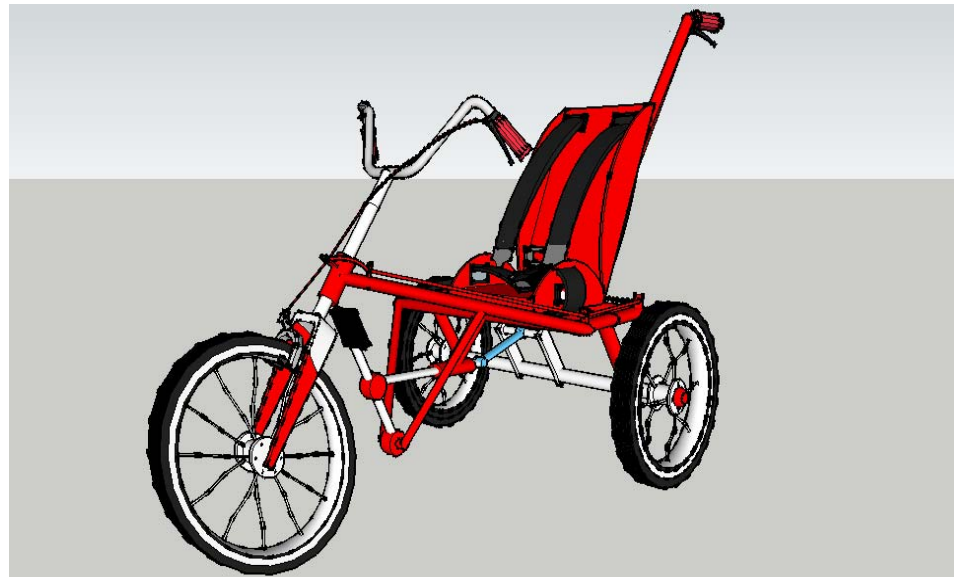
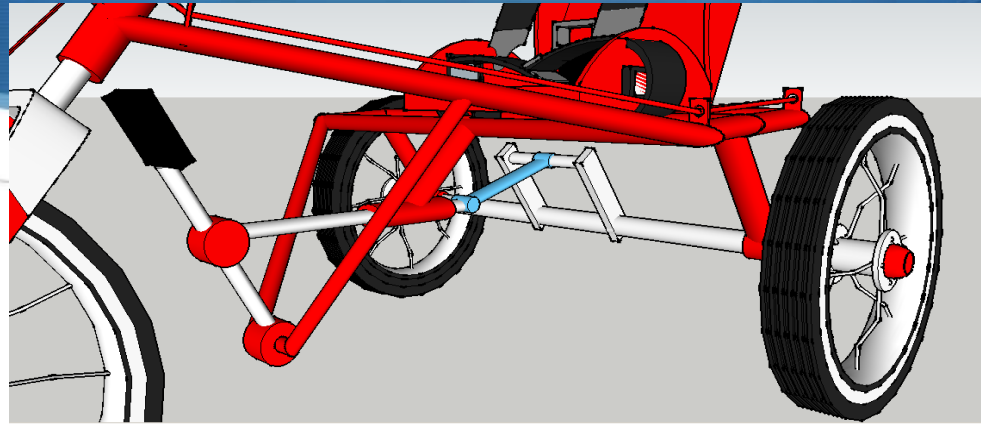
%RIDEABLE BY AMPUTED CHILD
rideable_1=rideable^2;
vettc=[sum(rideable_1(1,:));sum(rideable_1(2,:))];
vett_norms=vettc/sum(vettc);

% In matrix C there are weights of the single solutions according to our benefits
only(without considerations about costs)
C=[vett_norms vett_norms vett_norms vett_norms vett_norms];
D=C*vett_norms
    
```

And the Winner is ...!!!



Solution 1



An innovative transmission solution

The image shows a software interface for dynamic simulation. The main window displays a 3D model of a transmission system with various components highlighted in different colors (orange, green, blue, yellow). The interface includes a toolbar with icons for simulation control, a sidebar with a list of components, and a status bar at the bottom.

Toolbar (top):

- Converti vincoli
- Stato meccanismo
- Forza
- Momento
- Output grafico
- Movimento dinamico
- Forza sconosciuta
- Traccia
- Pubblica filmato
- Pubblica in Studio
- Impostazioni simulazione
- Simulatore
- Parametri
- Esporta in FEA
- Termina Simulazione dinamica

Simulatore window (top center):

- Buttons: Play, Stop, Previous, Next, Refresh, Help
- Time: 10,000 s
- Step: 333
- Current time: 6,01 s
- Progress: 60%
- Duration: 00:00:23

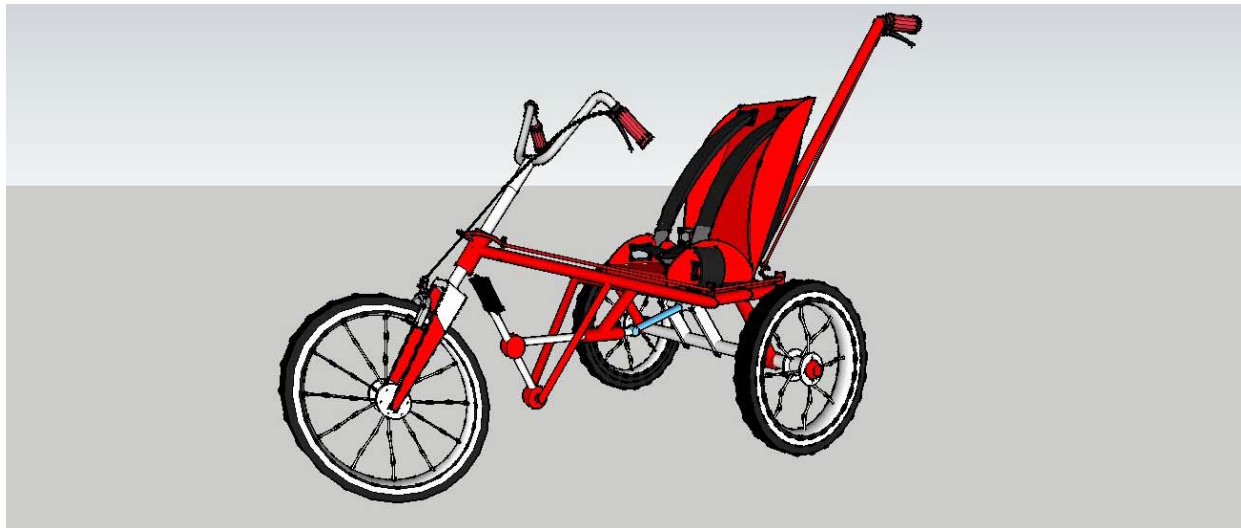
Component List (left sidebar):

- dinamica
- telaio:1
- Rotazione:1 (1,000 su)
- mobili
- asta:1
- manovella:1
- biella:1
- biella:1
- biella:1
- standard
- biella:6 (Manovella:1, biella:1)
- biella:5 (telaio:1, leva:1)
- biella:2 (telaio:1, Manovella:1)
- biella-Linea:4 (asta:1, biella:1)
- biella:3 (telaio:1, asta:1)
- biella:1 (Manovella:1, biella:1)
- scorrimento
- scorrimento: cilindro sul piano:7 (leva:1, forza)
- Smorzatore/Cilindro:8 (asta:1, biella:1)
- sterzi
- sterzi

Status Bar (bottom right):

- Page: 5 / 6
- Time: 11:22
- Date: 13/12/2013

General view of design



Conclusion

- Made 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