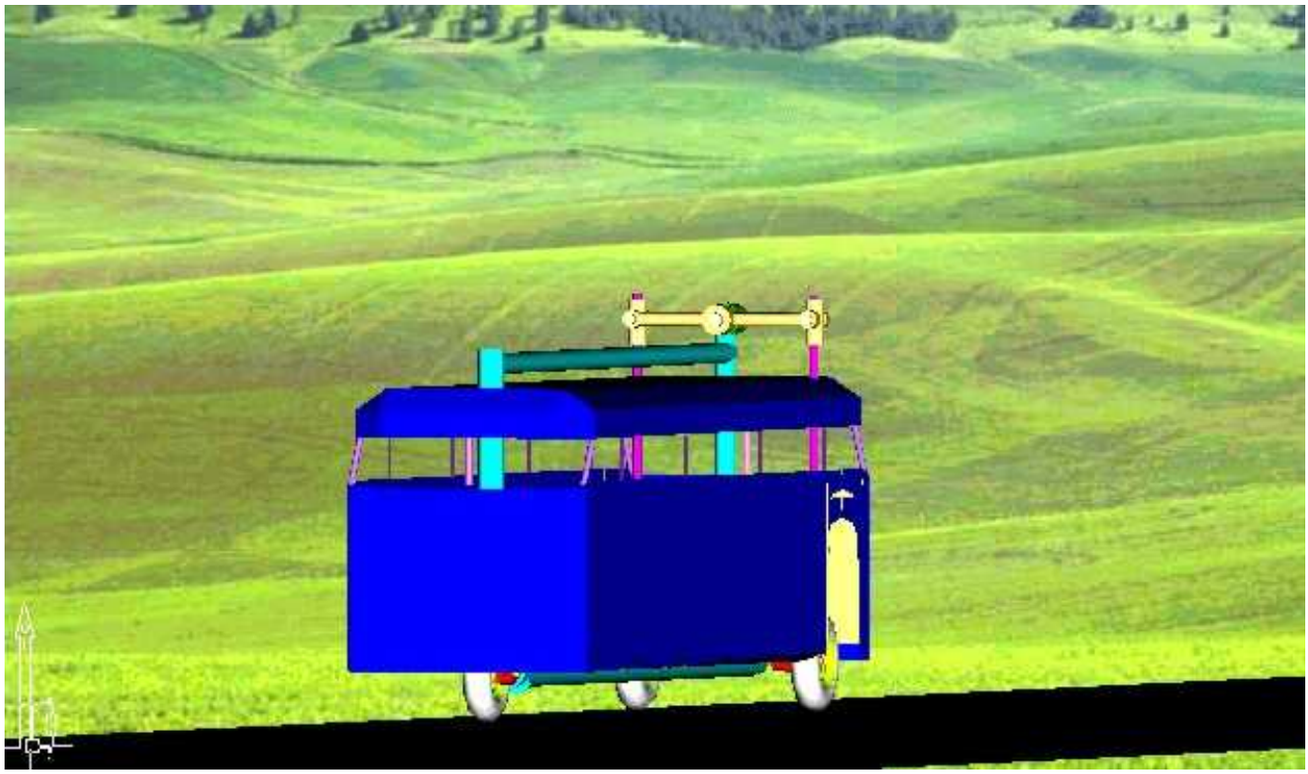
TILTING BUS

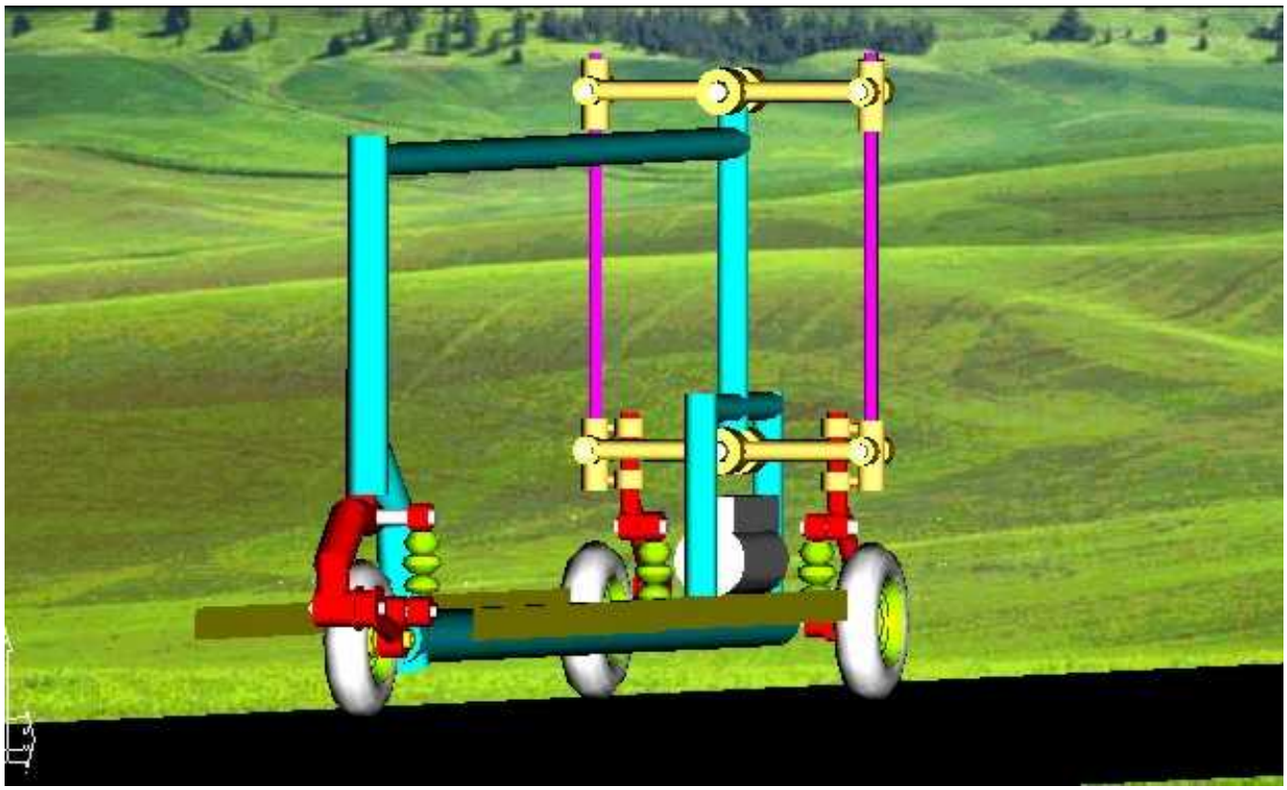
Dear Tilters.
I am very close to finishing my last crippled man's TTW. I'll keep you informed if it works as expected. As the operating force for tilting I am using capstans, as in old ships. An easy way of multiplying the friction force on a steel cable.
As I spend now a lot of time thinking in front of my computer writing articles that will never be published.
Making an abstract, my last trend of thought is about that ALL the land vehicles should be tiltable.
Nature through Natural Evolution made two main types of land animals (Putting aside insects): Two and four legged.
There were two main trends: The squatters, as the crocodile or the tortoise and those of very narrow track, as high running speed birds, humans and other bipeds, and most of the quadrupeds.
They are characterized by a very narrow track, just enough wide to avoid leg interferences and extremely high center of gravity (Think of the giraffes or ourselves). The reason for the extremely narrow track is the same as in our TTWs: To avoid too much extension in the exterior legs and too much contraction in the interior ones when tilting.
I am sure that a horse in mud would beat in safety any motorcycle in the same curve and at the same speed.
So Nature, cleverly has been doing just the opposite to what our engineers do, enchanted with the widest track possible and the lowest CoG.
If Nature says that the natural thing to do is to tilt if you want to be fast (A gazelle is ten times faster than a crocodile with about the same muscular mass) then we MUST make all our fast vehicles: Tilters.
So following this trend: Why not a TB?. (Tilting Bus).
To tell the truth, I did not come to the TB directly.

I began by trying to design a city bus with a very thin floor(5 cm= 2") so that it does not form a considerable step when lowered to the ground, easy for a wheelchair to step over.
There are aeronautical sandwiched or honeycomb panels capable of holding a bunch of people if they are anchored all around its perimeter (Maybe with the help of a little number of tension columns in the centerline).
So our design is taking shape. The chassis must be on the roof, and the floor must hang from it through the side panels reinforced if necessary with small spars.
Each wheel must have a potent hydraulic cylinder, capable of lowering a fully loaded bus and raising it back to driving height.
But now that we have all this. Why not make the cylinder so long that we could raise each wheel independently much more than the normal driving height?
There we have now an extraordinary 3D Tilter. Not just to the sides but also to the front for acceleration and to the back for braking
Look! . Just like the horses do.
But going farther: If we have a very long cylinder at each wheel. Why don't we connect them directly to the wheels, without any suspension subassembly, install a Citroen type gas sphere at the top of each cylinder to provide independent suspension to each wheel?.
But we can go even farther: By rotating the Cylinders around their axis we get an independent 360º steering for each wheel. We could take city sharp curves rotating not at the Ackerman style but around its center.
Everybody who has driven a long bus through narrow streets knows the enormous amount of pavement swept by the Ackerman in sharp corners.
Even more funny, you can turn all the 4 wheels 90º and get to your sidewalk parking sideways. This is an enormous advantage that every City Major would love.

More fun: if you get to the end of a closed street you may turn your bus, when stopped 180º around its center.
So by our design choices and installing a motor in each wheel. Hydraulic, electric or pneumatic, all these marvels are just a natural result of this extremely simple geometry.
Here are some CADs of concept designs, that really work on the screen, with no interferences or any other serious problem
I call them T4W. Although there is also one TTW probably better for high speed road travel, Specially in bad roads.

1F3T BUS

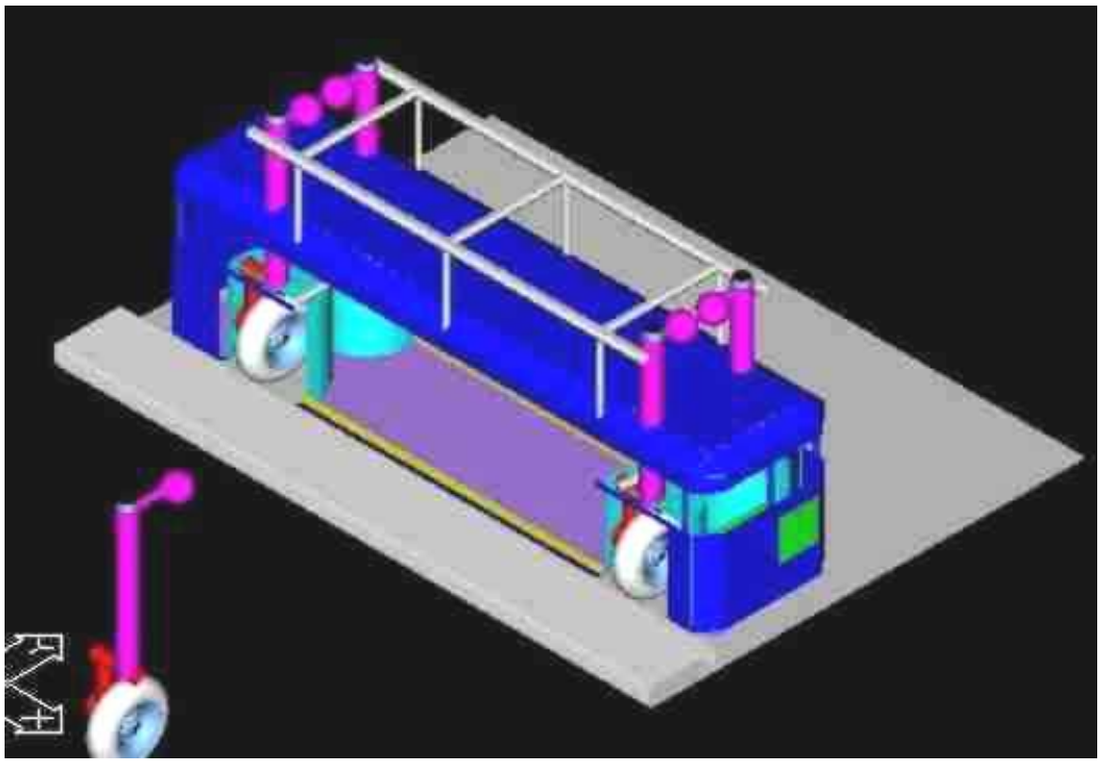




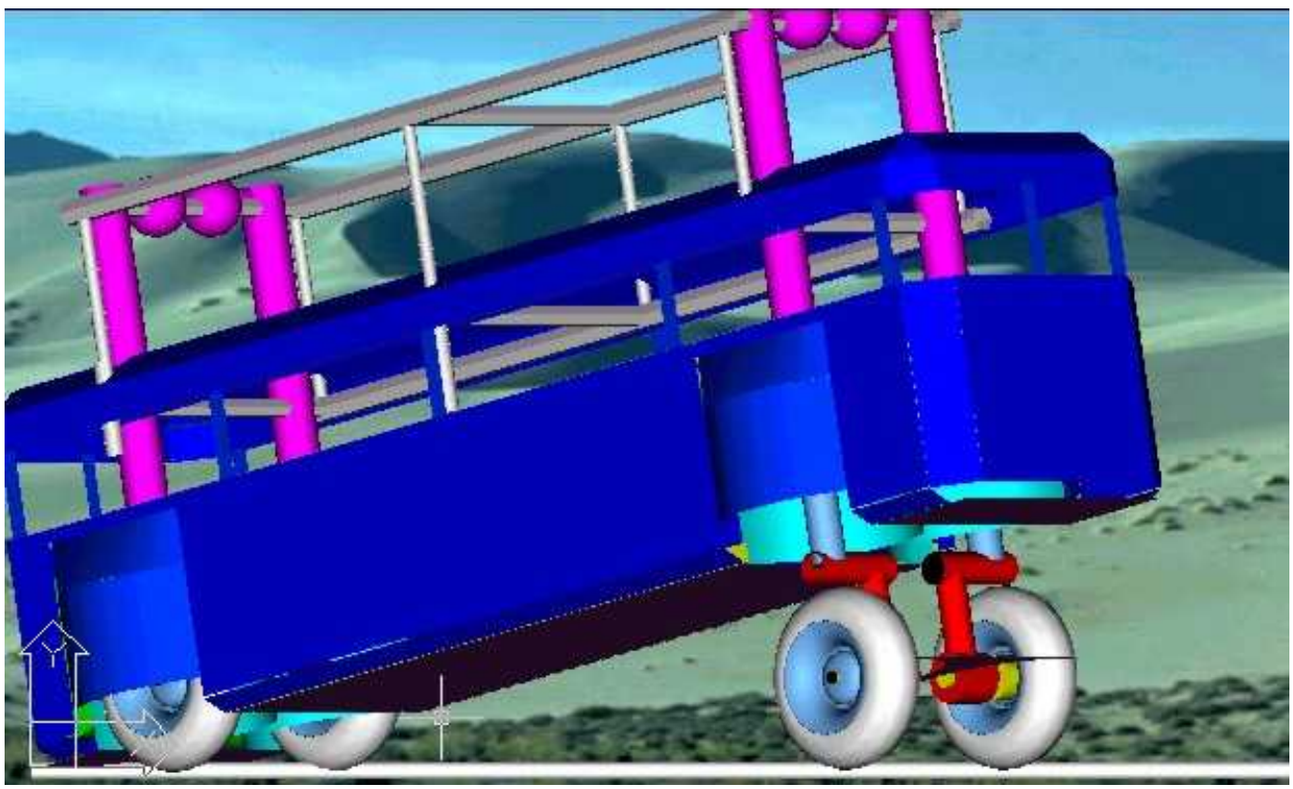
The same TTW with the body removed. You can see the strong fixed track tilting mechanism. the srong tube chassis, one of the tubes pass over the roof and the other under the floor.
The suspension are of the scooter type with pneumatic Springs/Dampeners.
This tilter can be tilted towards the sidewalk to make access easy.

You can also see the engine in a strong subchassis. The transmission could be mechanical or hydrostatic. I like better the second

T4W

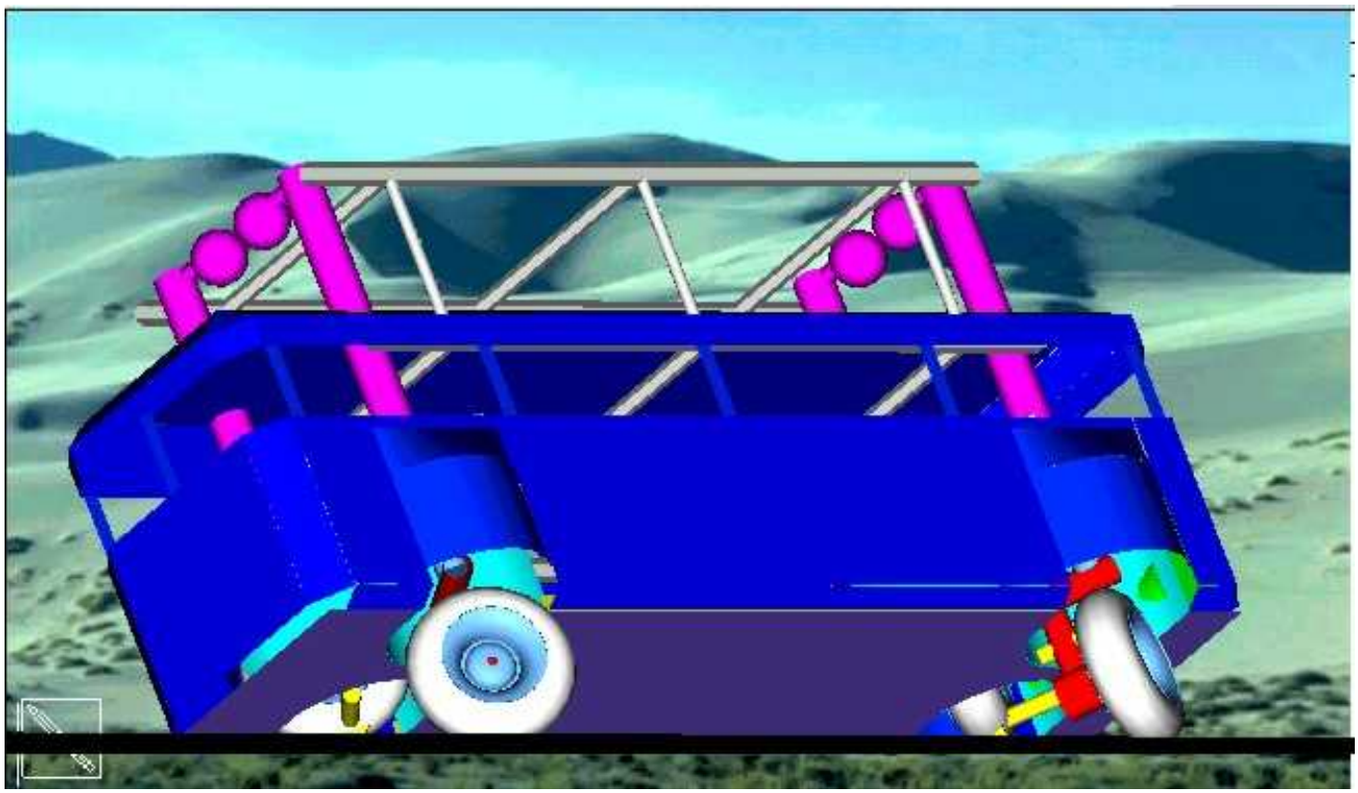


Here is a T4W sitting at a Bus Stop, Body has been partially removed. Notice the wheels turned 90º



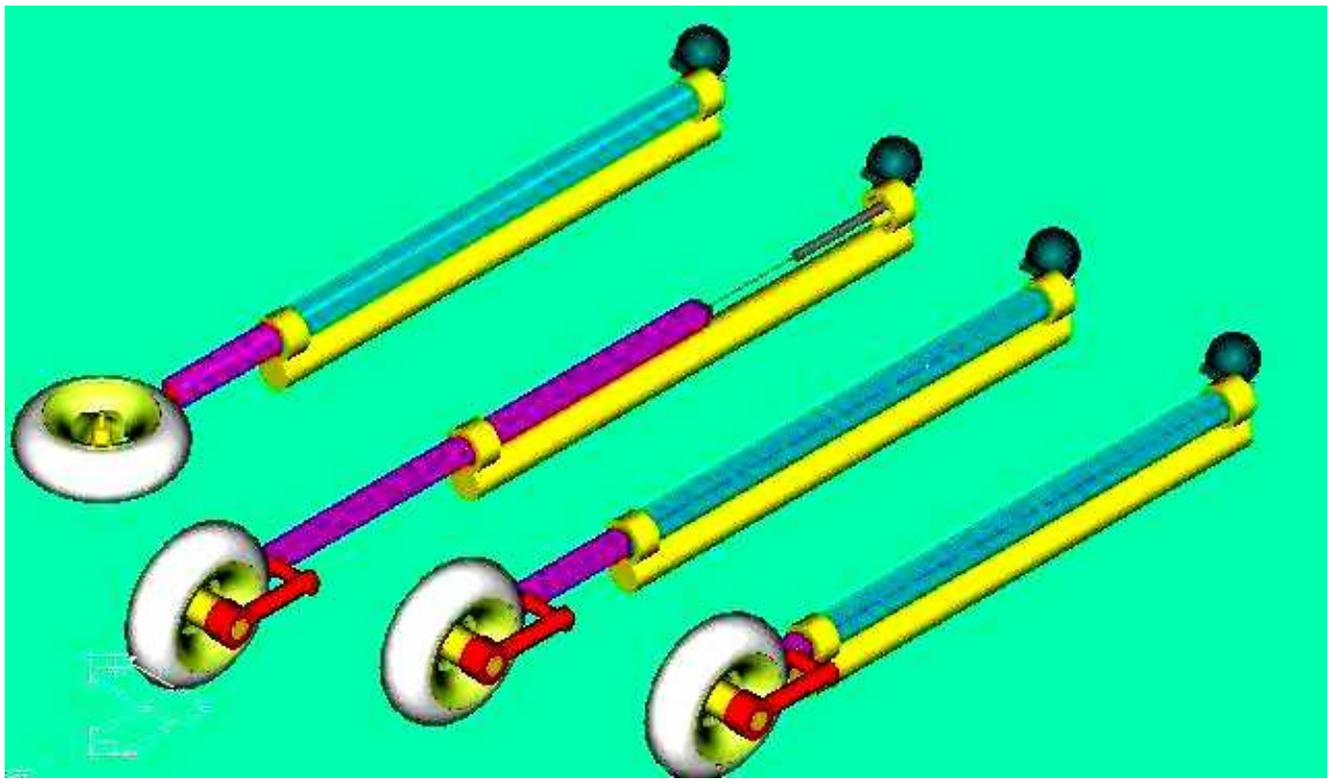
A hard stop. This is irrelevant for a road bus but very interesting

for a city bus where most people stands. Acceleration would be just the opposite. It would lean forwards.



Heavy tilting in a sharp curve. Notice how the coordinated front and rear steering makes the bus turn around its center.
Sorry that I had to put my city Bus in a desert. I do not have any city background

Any engineer knows that an hydraulic cylinder cannot be subjected to flexural forces.
So the a realistic design for this bus's suspension could be like shown here.



The yellow fat tube is fixed, bolted, welded or by any other means to the bus chassis.
The two yellow rings are bearings to turn the wheel assembly 360º.
The light blue tube is a square tube fastened to the inside of the yellow bearings.
The purple tube is another square tube that slides inside the light blue one.
This provides extension and steering.
As there would always be some flexing of these tubes, when braking for example. Specially at maximum extension, these tubes should be inserted with a large clearance but with rollers at the top end of the interior tube and at the bottom end of the exterior one.
This would provide a small friction operation with no side clearances.
The operating cylinder goes inside both square tubes and is connected to the purple tube at the bottom and to the yellow fat tube (Which is part of tha chassis) using the usual "silentblocks"

or ball joints. This hydraulic cylinder has the typical Citroen gas sphere at its top.
To steer the wheel you simply rotate the light blue square tube by any means not described here.
The fact that in this bus design everything is hydraulic is another BIG advantage,
Using hydrostatic power transmission to the 4 wheels is is easy to brake with the wheel motors accumulating the energy in the form of pressure in a reservoir, releasing it in the next acceleration.
The MPG would be excellent. This type of transmission that has been tried many times does not make sense from the economic point of view.
Here where we already have an hydrulic system for a different purpose it would make a lot of economic sense its use in the power transmission too.

The engine runs at constant speed, so lowering pollution to the maximum. The exaust silencer can be tuned to this speed and the cathalitic converter too

Nothing here is fancy engineering, maybe except steering that possibly would need computer control, due its many possible configurations
3D tilting could be made intuitively by the driver.
Look, Mitch: I do not have the slightest interest on patenting this (Or anything).
But some of our readers might want to patent it.
I believe that publishing a document in a closed list of persons does not produce in legal terms a "Public disclosure". What do you think?.
So please publish it only if you are SURE that it would not be a "Public Disclosure"
The only inconvenience that I can see for this bus is that looks very strange and that is really tall.

It may have problems with bridge clearances. But this is a matter of design.
Melchor Duran
P.S.
Let me add all the major features using this very simple design.
1º- 3D tilting. Left and right. Front and rear. And up and down.
2º- Lowers a thin unobstructed floor to the pavement, Easy for wheelchairs.
3º-Can park completely sideways at the Bus Stops. Great for street traffic
4º- Can make very sharp turns, sweeping a minimum of pavement.
5º- Can turn over itself 180º when stopped.
6º- Can be driven in a slanted way. I ignore what this could be good for.
7º- In case of total steering failure it still can be steered like the tanks, by differential power.
8º- In case of total failure of ALL the systems, it would fall flat to the pavement and brake roughly by pure friction.
9º- You do not lose the braking energy, you accumulate it. This is very important for City buses.
!0º- Theoretically, the 3D tilting sould provide an excellent stability to the standing riders.

No doubt that if this Bus ever makes to the streets will produce an enormous amount of jokes.
This is a very good symptom. It would mean that it produces a great social impact