SSV PART II

Report

TEAM: PM18

RAMPAGE

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1. Engineering

1.1 New Sankey diagram of our SSV

The New Sankey diagram we made is based on the practice we made on the track, our vehicle runs 12 meters which means 8 meters on the flat track, this value helps us to find out the internal frictional loss of our vehicle, now we can specify the value of it. Here is the method

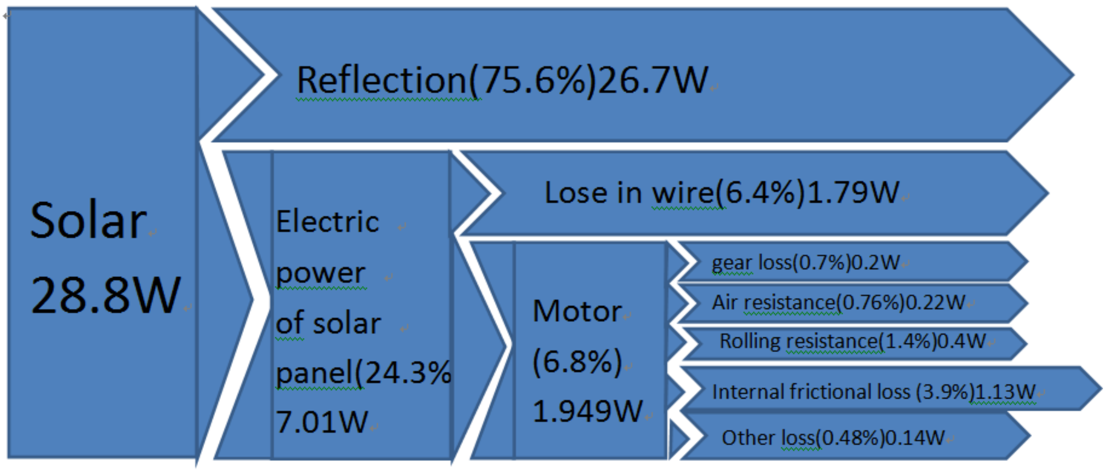
Since the potential energy of the vehicle is W=mgh=1.2*9.81*0.5=4.7J

So we can figure out the total resistance force which is W/S=0.49N,

At that moment, the power consumed by the resistance force is Pr=0.49*4.1=2.01W

This value includes the air and rolling resistance power consumption, thus the internal frictional loss is 1.949*0.9-Pair-Prolling=1.13w, if we compare this value to the old version, we can find that the old value is 1.27w, hence we get all the rest loss like heat in motor and some other things in total is 1.27-1.13=0.14w

The rest of the calculations remain same and can be viewed from the previous SSV part 1 report.



The power generated by the solar panel is P=(E+I*R)*I, substitute values, we get

Pp=2.1w

The power that the motor delivers is Pm=E*I= 7.99*0.24=1.949W

The energy loss in the wire is I^2*R=0.19w

If we assume the efficiency of the gear is 0.9,

Then the gear loss is 1.949*0.1=0.1949w

For the aerodynamic loss

P=F*v=Fw *v= ½ · Cw · A · ρ · v^3=0.5*0.5*0.01*1.29*4.1^3=0.22W

For the rolling resistance loss

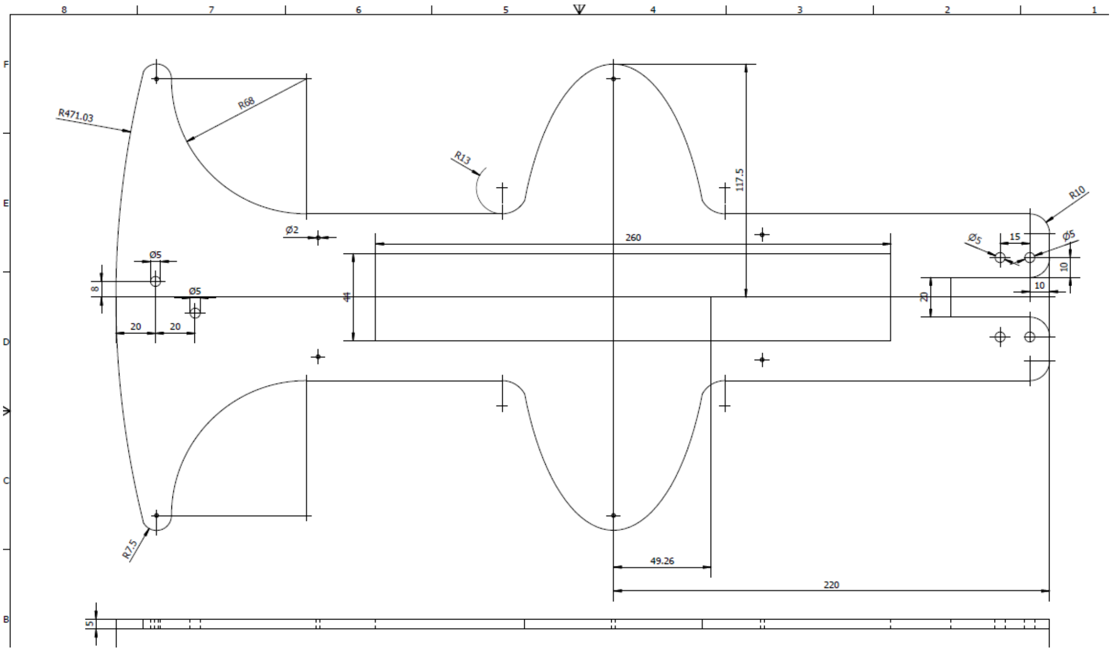
P=Crr*N*v=0.01*9.8*4.1=0.4W

So the internal friction loss is 1.949*0.9-Pair-Prolling=1.13w

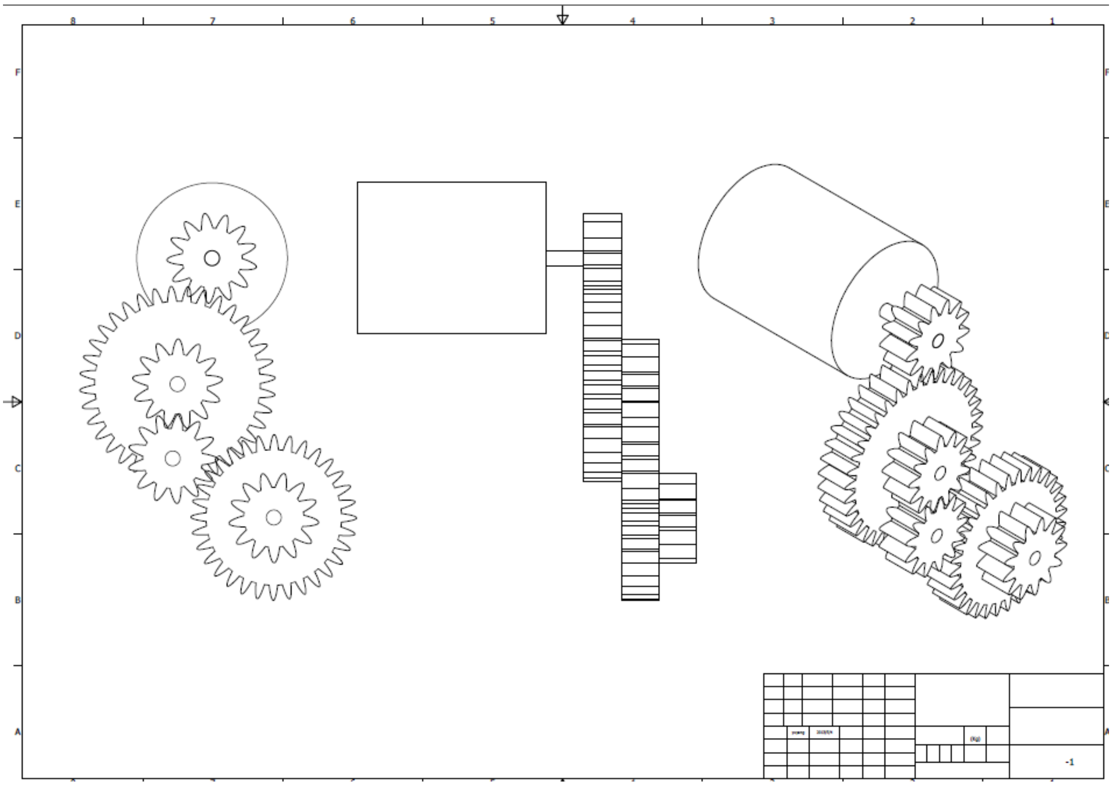
Heat and other uncountable lost is 1.27-1.13=0.14w

1.2 Detailed calculations for the shaft and solar panel.

1.3 2D technical drawing



The detailed drawing of the shaft and our gear box



2. Enterprising

2.1 Webpage

We have or the detailed information about our SSV ranging from the structure to the race

simulation.
https://cygnus.cc.kuleuven.be/webapps/portal/frameset.jsp?tabGroup=community&url=%2Fwebapps%2Fblackboard%2Fcontent%2FcontentWrapper.jsp%3Fcontent_id%3D_9956267_1%26displayName%3DLinked%2BFile%26course_id%3D_477066_1%26navItem%3Dcontent%26attachment%3Dtrue%26href%3Dhttp%253A%252F%252Fen.wikiversity.org%252Fwiki%252FTopic%253AEngineering_Education%252FEngineering_Experience_4%253A_Design_a_Small_Solar_Vehicle

2.2 Create team logo

The team logo has our team name on it which can be found on the flat inserted in the SSV.

2.3 Cost

To finish our SSV, we need to find the gear that we need, so we bought a remote control car so as to transfer the gear box on it to our vehicle. The cost of the toy is 15euro.

The material that we used to make the frame consists of two parts, one is the test part, the other one is the final frame.

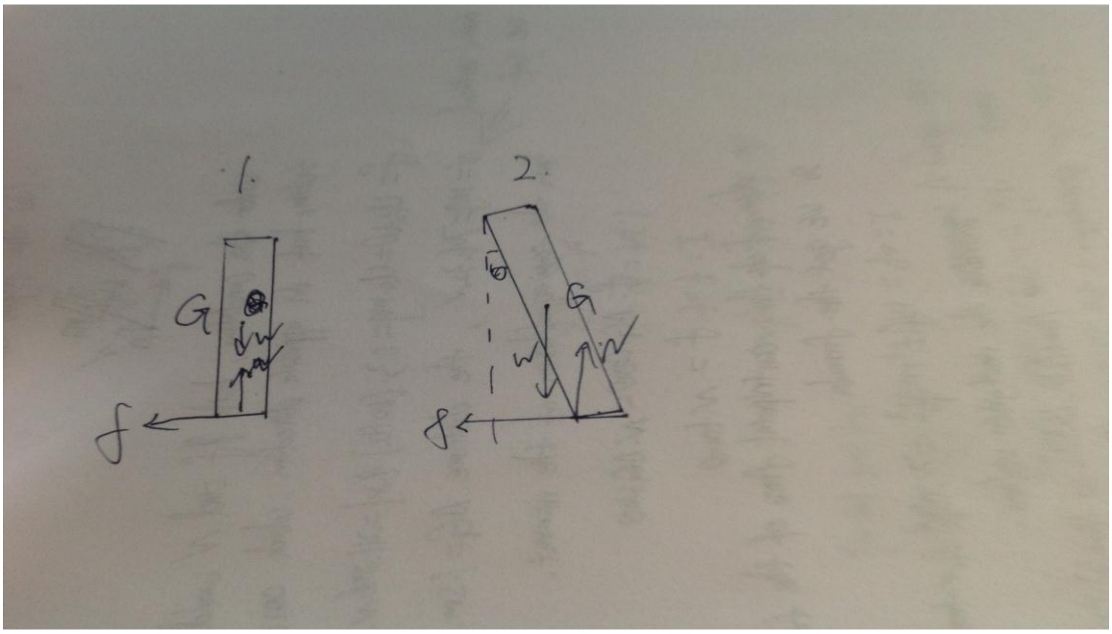
We have 2 wood boards of 3mm thickness and 1 Plexiglas board of 5mm thickness, each wood board costs 1 euro, and the Plexiglas board costs 11euro, the final frame is made from a Plexiglas board, so in total 2*1+11*2= 24euro.

What's more is a 9V battery costs 15 euro

Thus in total the cost is 15+24+15=52 euro.

4. Technical questions

When the man rides vertically, if he would like to turn to left, the friction force of the ground would exerts on the clockwise moment, which seems to be turning the bike clockwisely, we we need to incline the bike to left like the figure shows below



Under this condition, both f and N would exert moments to the system, but in opposite direction, which could keep the bike a stable turning.

The static friction force f=Us*mg=0.3*(60+12)*9.81=211.896N

From the initial vertical situation shown in figure 1, we get the equilibrium equation N=mg=706.32N, the distance AG=1.5m

From the equilibrium of the moment, f*AG*cos&=N*AG*sin&, we get f = N*tan&

Also, f is the centripetal force of the turning bike, use the formula we get

F=m*v^2/r and we get m*v^2/r = N* tan&,

Since v is 50km/h equals 13.89m/s

Introduce the given values

13.89^2/10=9.81* tan&

We get tan&=1.967, so &=63degree.

To finish a safe turning, we need the static friction >= Us*mg=211.9N

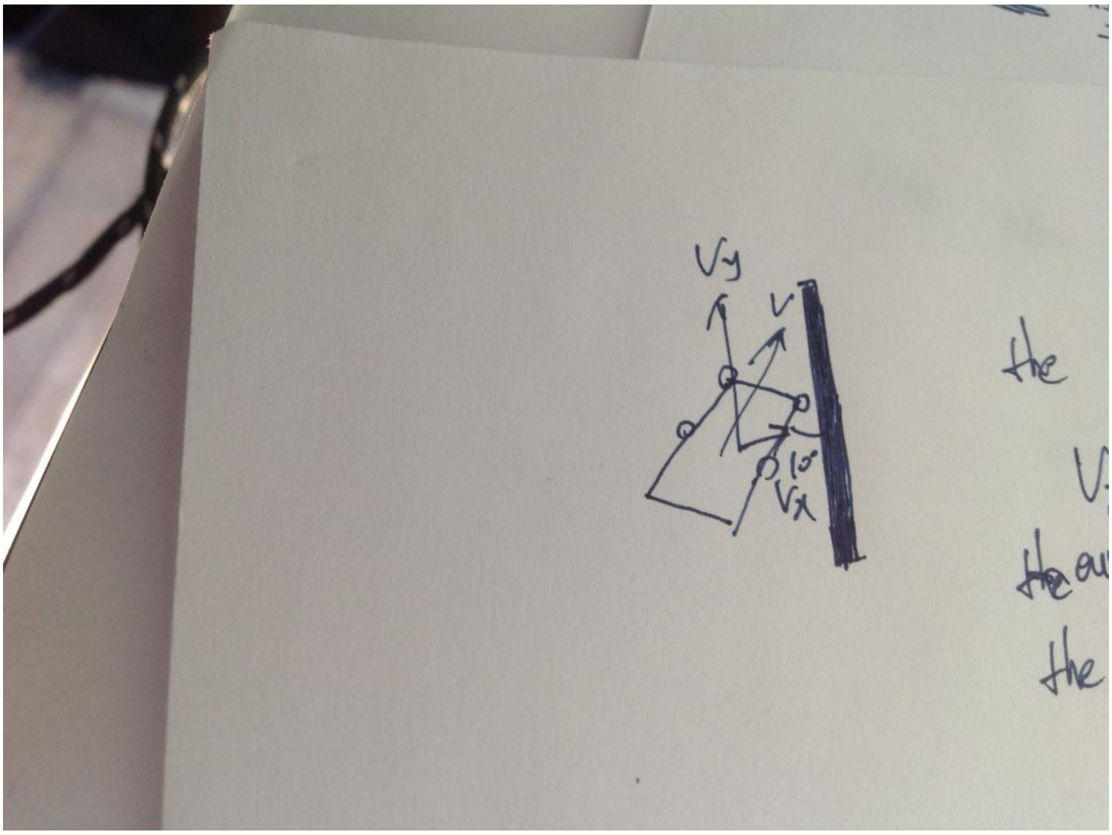
Which means he needs friction force 1389N, so he needs incline the bike 63degrees with respect to the vertical plane, but the maximum friction force he could get from the ground is 211.9N, which indicates that he would fall down!.

Apparently, he has to decelerate until he gets the max friction force 211.9N .

From this condition, we get f=211.9N=mv^2/r

We get v = 5.42m/s and the corresponding angle f=N*tan&, thus & =16.7degrees.

5. The technical questions relate to our SSV



The Vmax=4.1m/s, from the figure above, the horizontal component of the velocity Vx=V*sin10=4.1*sin 10=0.71m/s

And our SSV weighs 1.2KG. hence the momentum is m*Vx=1.2*0.71=0.854kg m/s

From the assumption, the elastic collision means Vx'=-Vx=-0.71m/s

Now we use the theory of momentum I=deltaP=m(V1-V2)=1.2(0.71+0.71)=1.704kg m /s

With the definition of the Impulse I=F*t which is 1.704=10*t

We get t = 0.17s.

So the conclusion is that it takes 0.17s to finish the collision if we want to keep the force at 10N