Physical Models for Electronics Enclosures Using Rapid Prototyping
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Lecture - 13
3D Printing Detail 2

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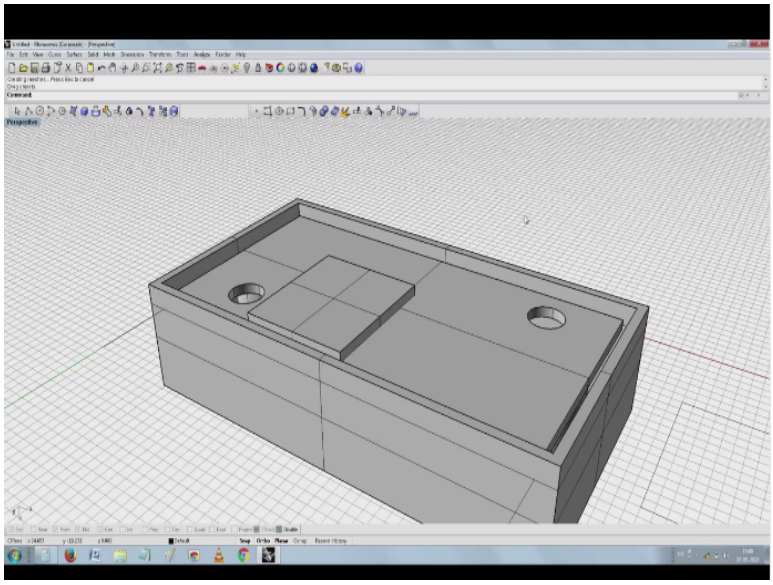

Have a look at this power supply.

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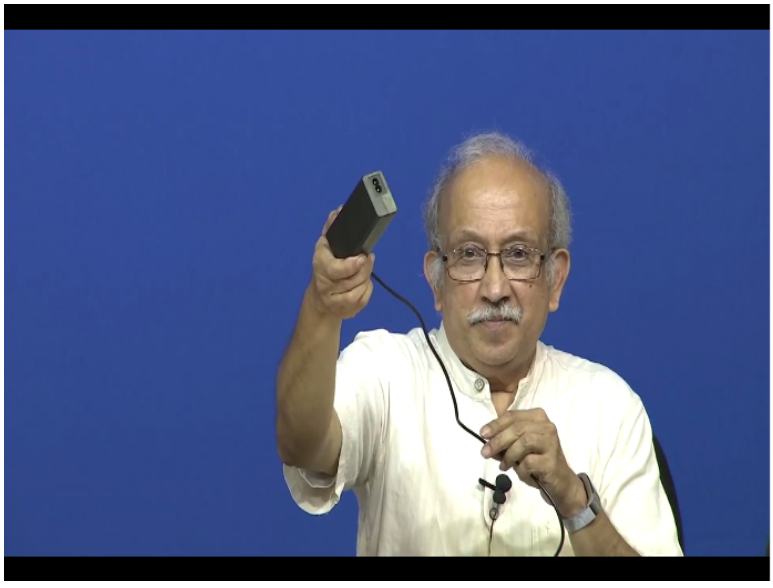

This is taken from my computer; it says Vivo which is I mean typically. So if you have to open one of them, immediately some of the power supplies invariably had a big heat sink sheet here and because of various practical purposes, the whole thing is enclosed and these

days several of this plastics are capable of taking higher temperature and if you can make it touch a lot of heat can be made to lose from this.

So a similar technique I will try to use there. So you see here I have two options, one is build a heat sink in the small gap which I have already shown here.

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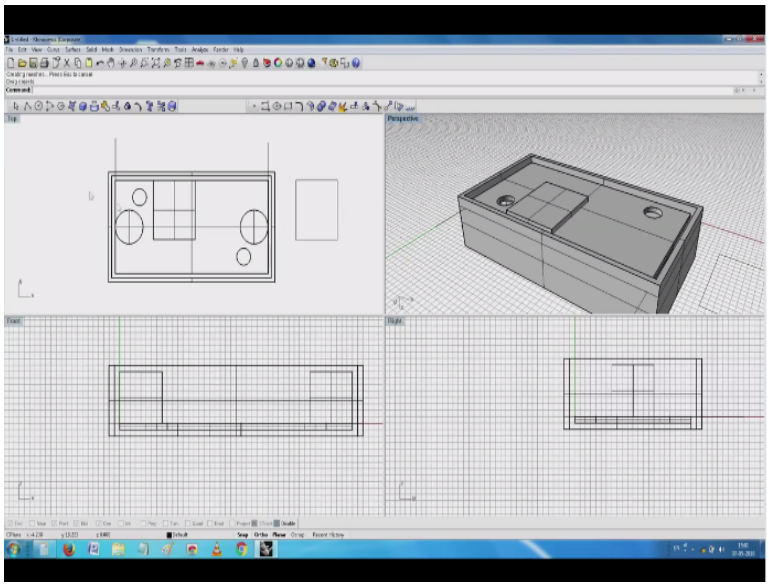

I have a small gap here. You are seeing this, so I have two options. I can make a heat sink which is wrapped around and completely goes off inside and gets attached here and then close it or alternatively if what you call the amount of area that is available and the thing is easier, all I need to do is now make a cover for this device which is completely made of a conductive.

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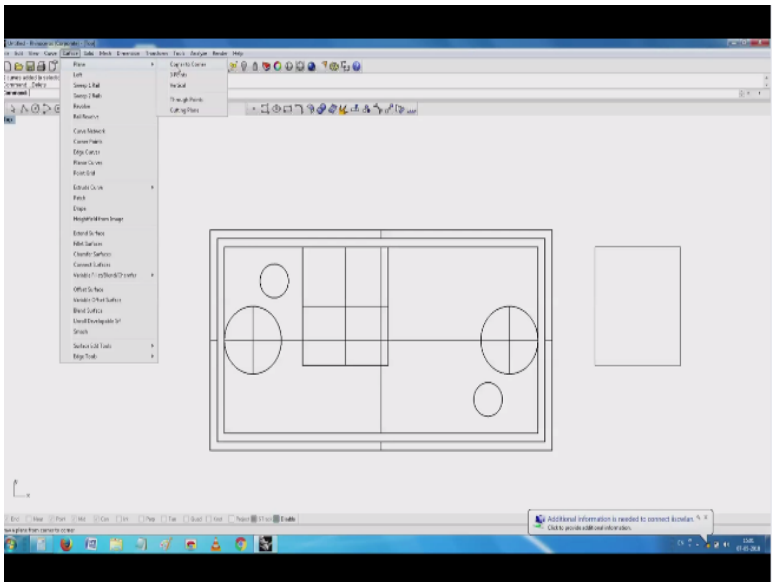

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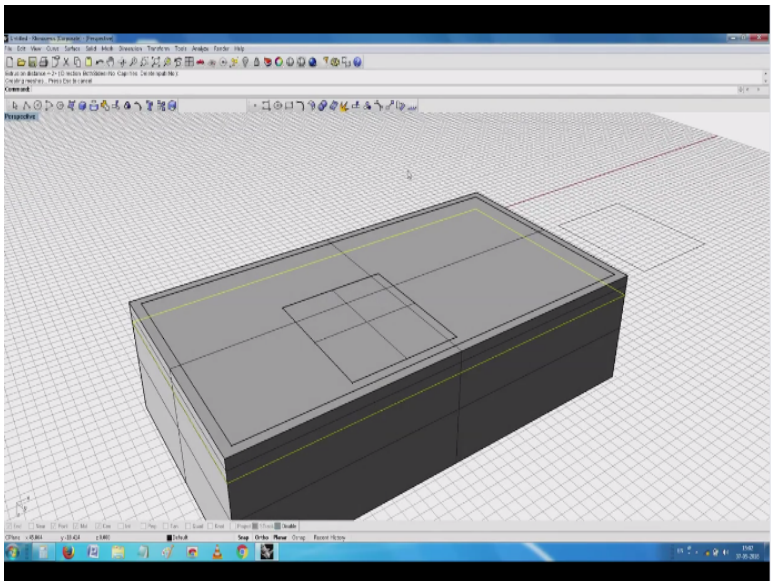

See there it is a beauty. I have now a small what you call aluminium cover which is happily sitting on top of this and I can play with it and in this case now more by accident and less by intention the thickness has become a little more but still it suits me.

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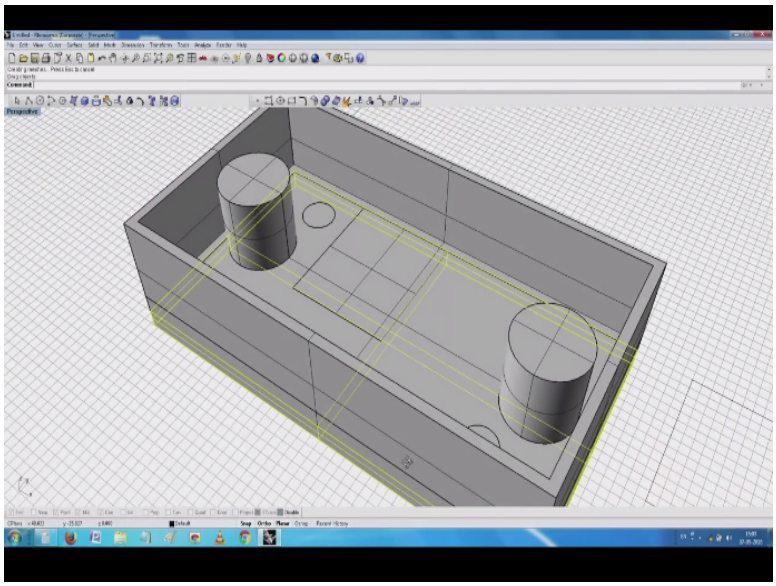

You have seen this, now I have got a cover which is happily sitting on top of it and at the bottom I have a heat sink and the whole thing is attached together. Now it is very much possible for me to take this, attach it to this, union the thing.

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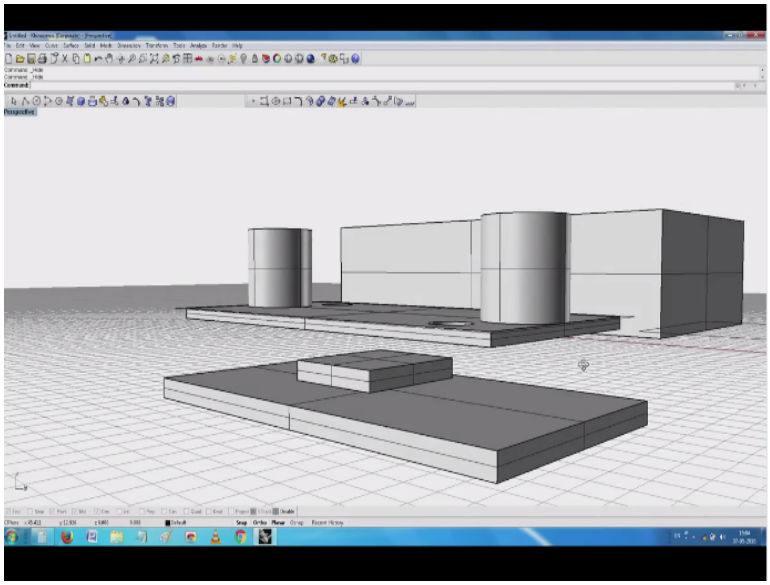

See I have all the necessary things. I have a plate with an aluminium what you call, it is a heat bridge, then I have my printed circuit board on top of it and then I have a cover on top of it. Now from here onwards know it make sense saying how do I now take the other decisions which are related to my project here. Obviously, one of the important things is how do I close the whole thing, how do I clamp it?

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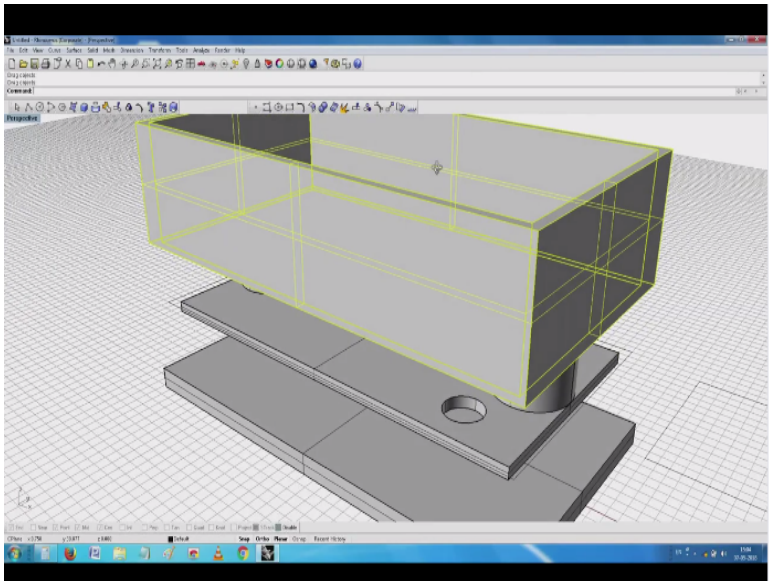

These two are obviously metallic objects and this is the 3D printed item. All I need to do is make a cover here and probably make some arrangement by which these two mounting holes are there know I get it made in this. I will just show you quickly and then after that I will take what I call short break.

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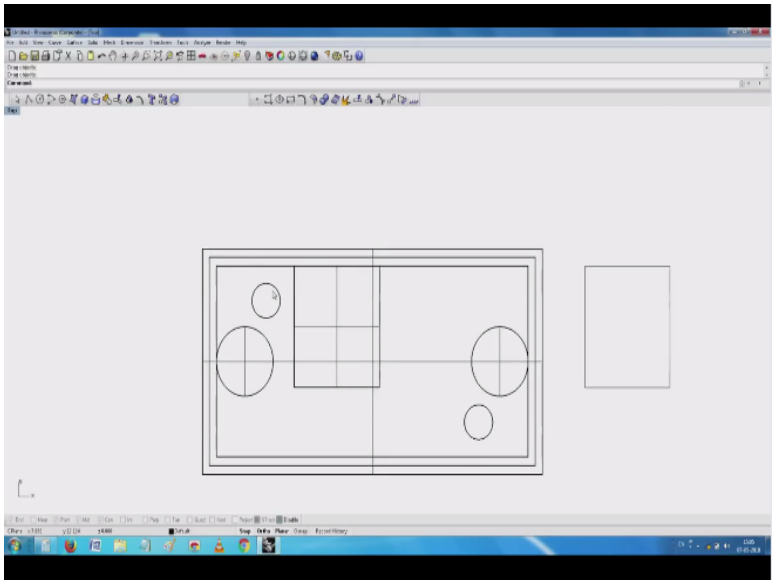

You see I have a hole here. I just need to make one more circle. See I have a beautiful circle here and I need to make a small pilot hole in that circle and make extrude.

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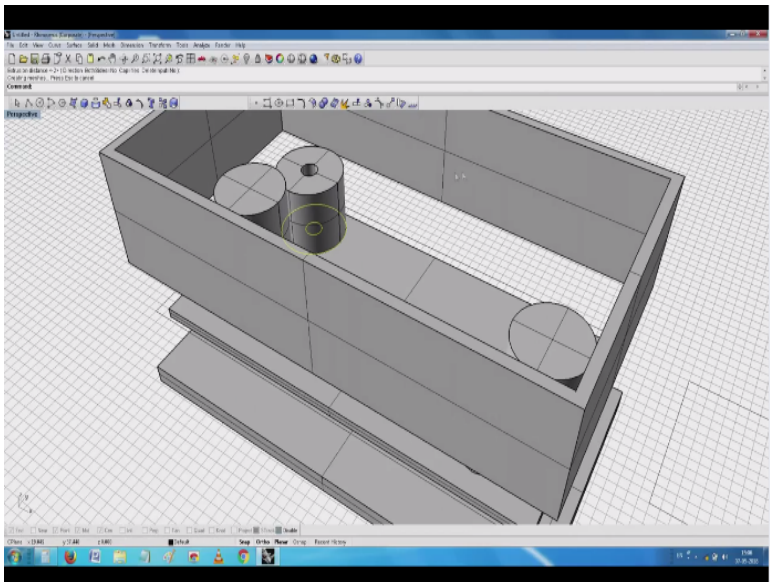

See I have got a beautiful mounting detached here which I can make. See I have two beautiful circles which are nicely now part of this except that you will notice already know first I have done a small goof-up here, you have seen this. This is interacting there and it might be creating problems for me. That is where you have an advantage when you are working with CAD.

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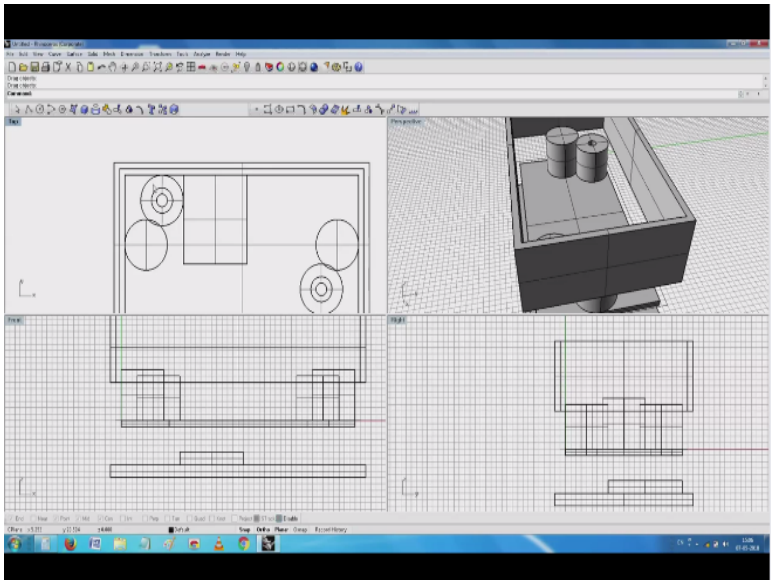

Several options one is depending on the strength this is decided, so what do you do, you can just cut off this portion see that it aligns perfectly. Alternatively, I can make this a little smaller, critically small but then I was hoping this will touch here. So this is where now I try to now remove only the details which I need, all other things I will hide, now start playing with it.

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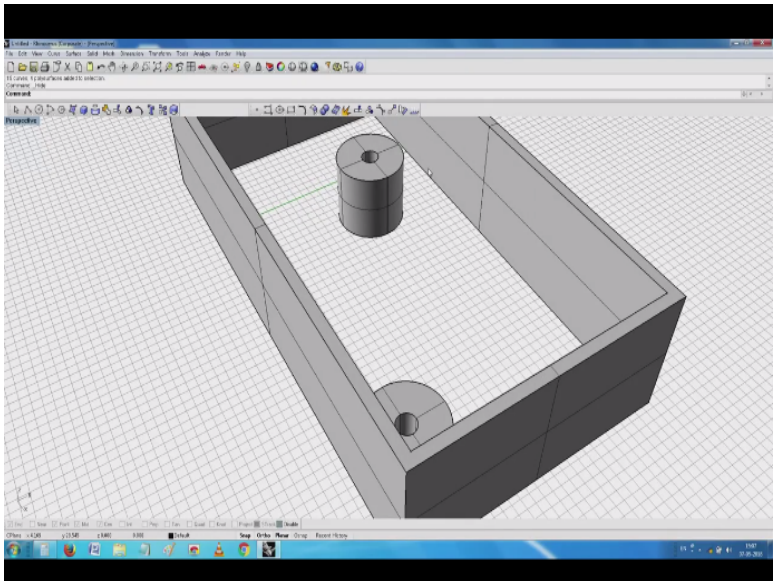

See I have got two mounting holes. I have got the outer thing. I need to do something such that these are attached together. So this is where our ingenuity and little bit of what you call things come about saying how do I join them here. In the case of injection molding, if you remember there is always issue about maintaining a constant thickness. In the case of our thing that is not the main issue.

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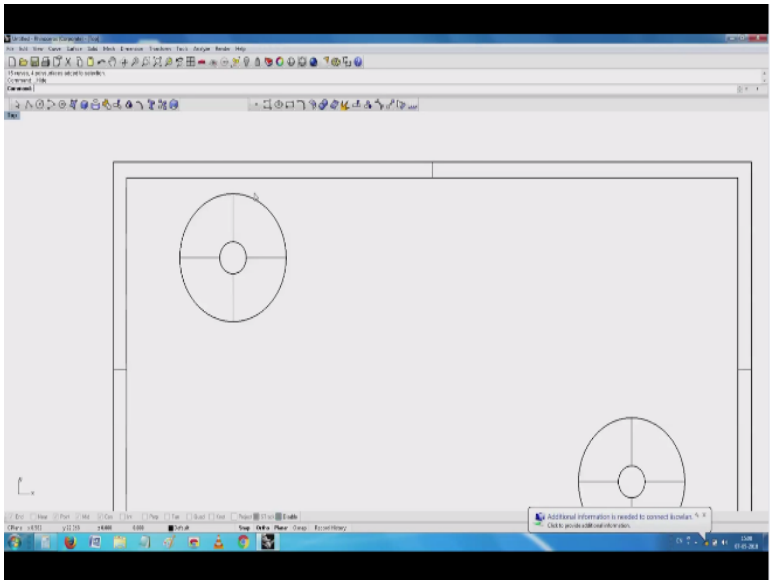

So it is very much possible for me to just maybe join this here, so that overall material required from the support point of view is avoided. So what I will do is now I will try to make a small like what you call one more time a small surface, corner to corner I start here and extrude this.

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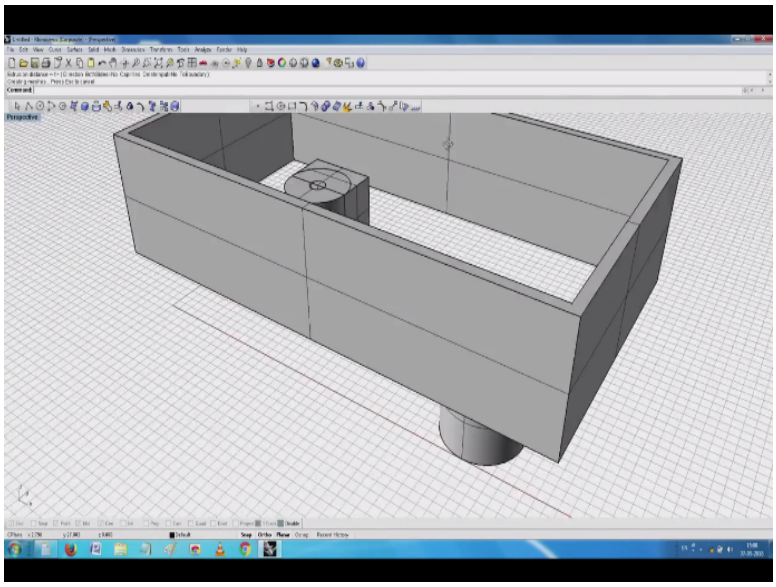

See beauty without too much of problem, I have this and then why did I make it solid compared to the other thing this is where one of the detailing which is very much part of this what you call any 3D printing is required. If you have to make parts which are similar to what you would do with an injection molding, we end up with certain priorities which are very, very different.

In this case, we need to maintain such that the support material is not required. The main material is anyway consumed but in the case of if you see our injection molded parts, constant thickness has to be maintained otherwise injection does not take place.

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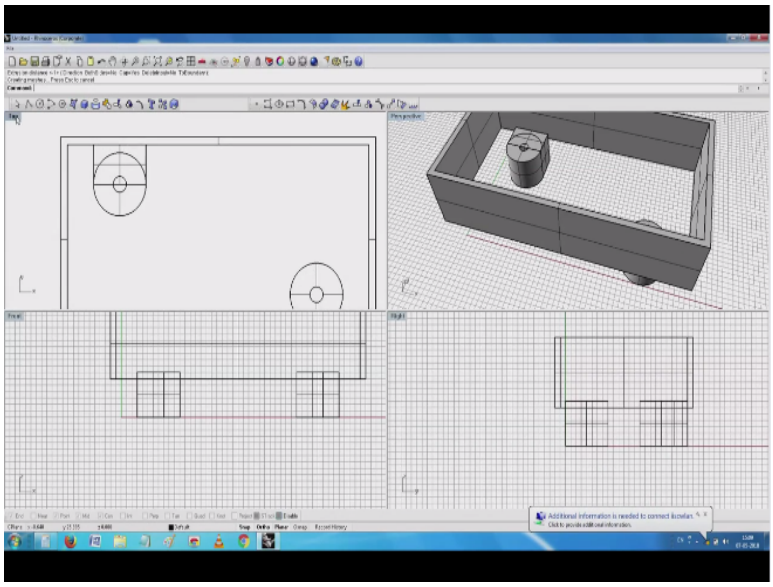

So I have this two beautiful what you call buzzes here and then I Boolean these things. Oh some bomb here kindly what you call excuse me for the bomb. Yeah that is a rigid part. I just need to copy that same part here. Now because it is a symmetrical object, I did the easier thing. I just went and what you call mirrored it up and then I will now take it up, union this whole job. In case it does not union, I have some other problems.

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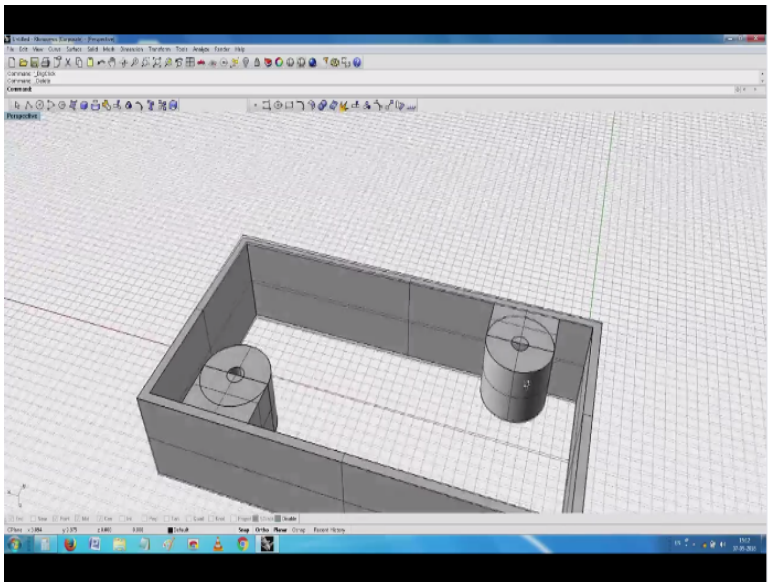

You see my basic this thing is ready now. These all the things that is required. So on this if I now switch on the other hidden layers, I have my printed circuit board which is on top of it.

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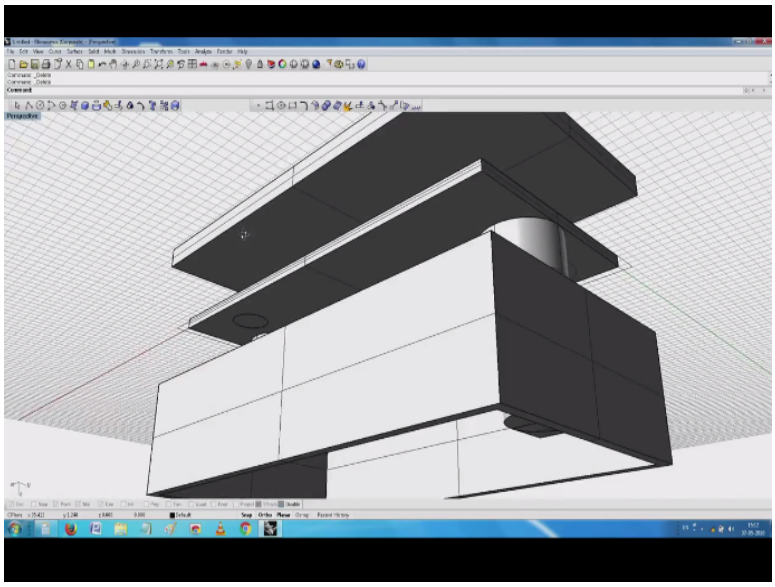

You are seeing that that is a printed circuit board. Then, I have what you call heat sinks, which sits on it. Now if I am careful enough or clever enough, it is possible for me to also you have seen that now. I can use the same mounting hole which is here to come and then clamp all these objects together. See in this now it is very easy for me. I can clamp all these objects together.

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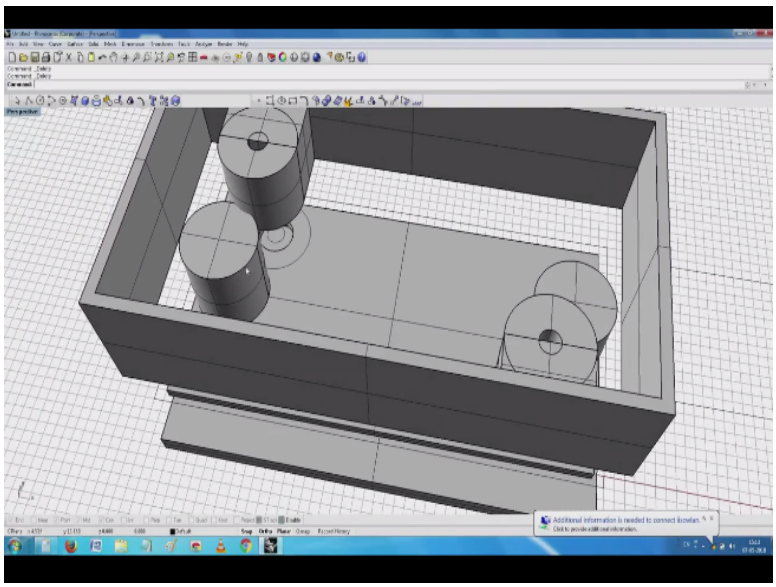

Do not get too much worried about it, I will remove this thing. Right now, slowly that my basic this thing is ready. Now you will notice, only one thing you will notice is it made sense when I was trying to build it up from this side.

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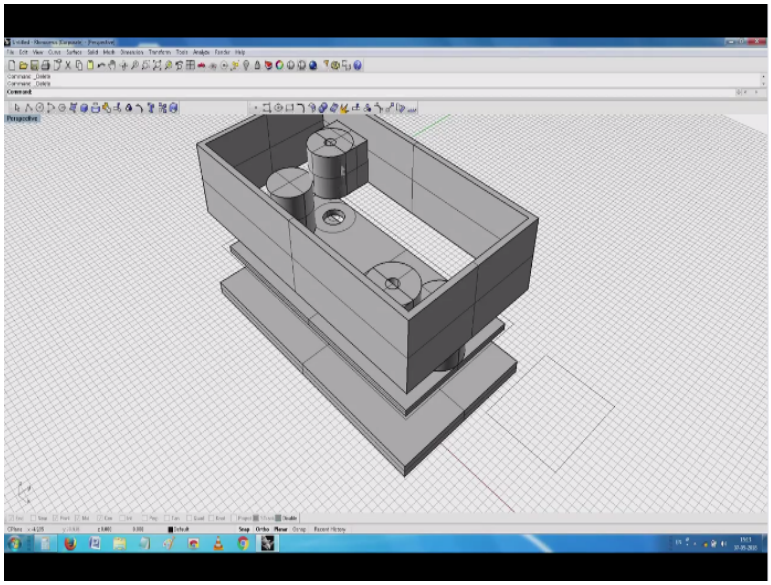

Now comes the next thing. Can I now make another cover? directly can I happily close the other end? You have seen this here know, can I close the other end and then complete the job.

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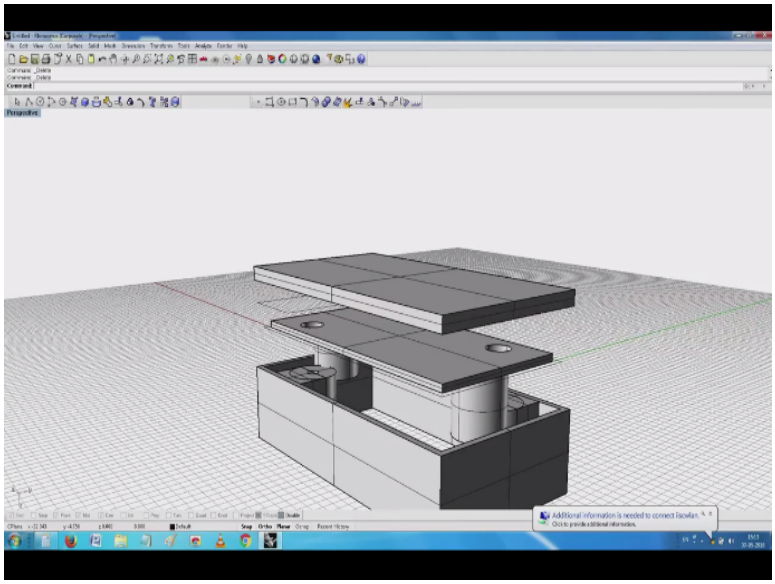

So you see here ahead actually with the little bit of trial except that sequence did not come properly, I tried to make a gap here. It is possible that if it was a symmetrical object and it is not what you call attached to each other know, it is possible for me to see whether this printed circuit board can now be shifted up.

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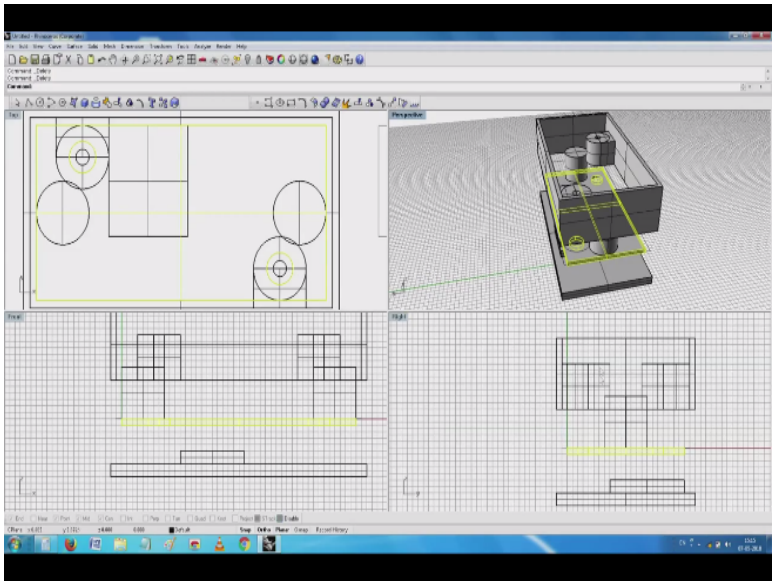

Nothing, it is just the sequence know, I am just reversing this sequence so that the circuit board sits here. I have both these capacitors here and then this heat sink can assembly goes on top and then see whether I can now do something and invert it and say whether the things are okay. You have seen here, at least one part of it has been partly taken care of.

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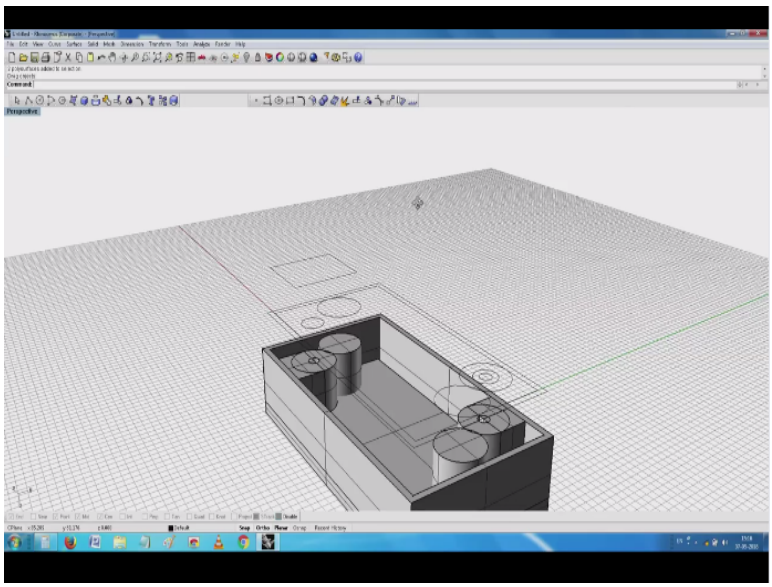

You have seen this. It is possible for me now to put the PCB on the other side. It just need to do something, I need to just invert it and what you call the usual little bit of circus. See in this, PCB is happily sitting here okay and then other side we also have this nicely what you call attached to the other surface and then I lift it a little and then see it is much better than what we had started can you see here now.

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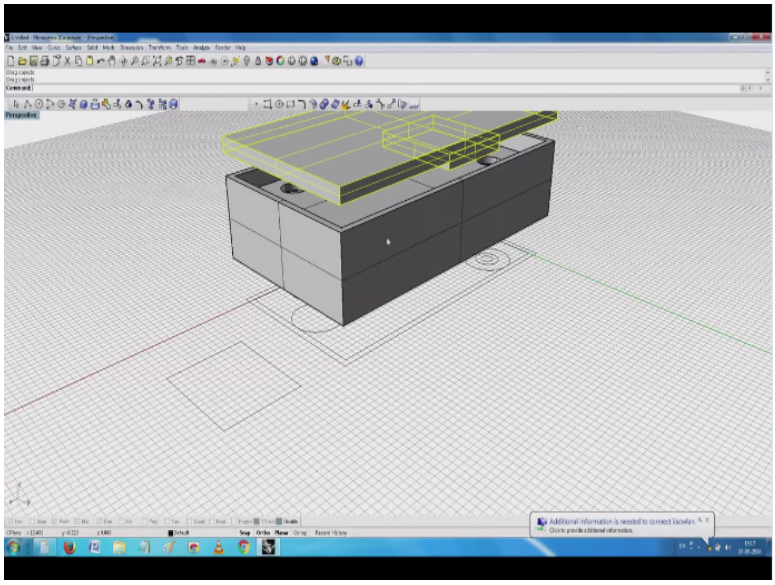

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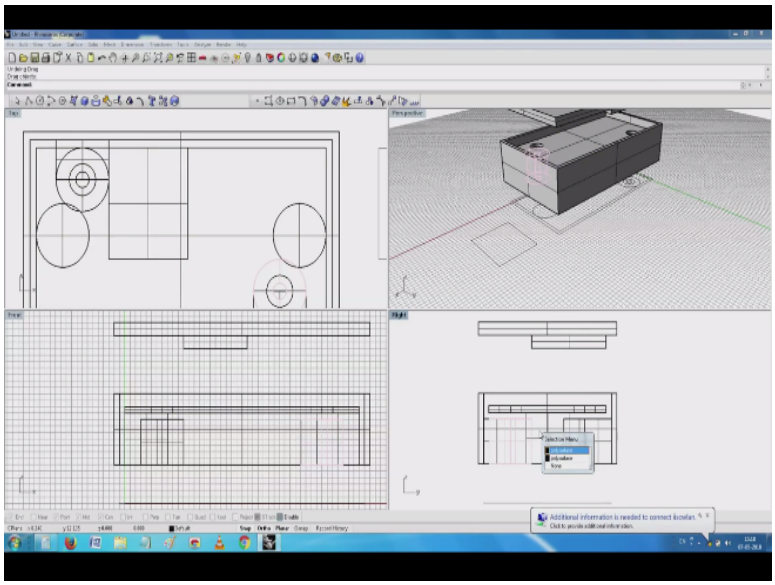

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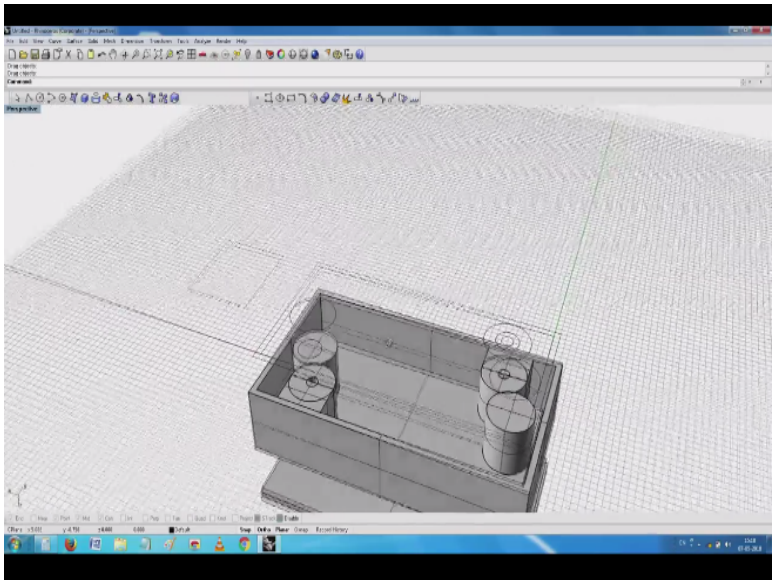

See in this, we have a support structure here and we have the printed circuit board which is happily sitting on top of it and the other side we also have a place for the heat sink. Now it is for me to decide whether I can continue with this opening here and then when I push all of them together, I need to assemble them alternatively depending on whether I need to open it again and it is a one-time affair I can even put a super glow and leave it like that.

And hoping that things now there would not be any absolutely no issue. Things will happily settle down and get clamped without the slightest problem.

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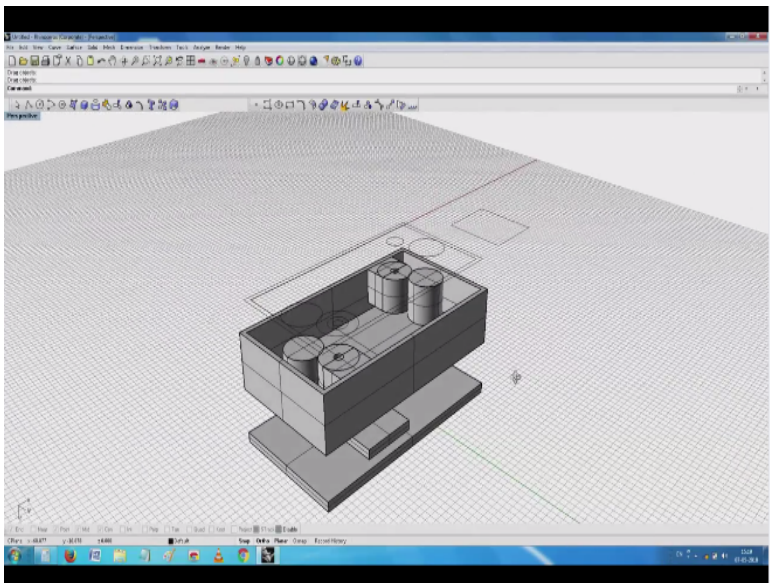

See I have a nice this thing. I have the supporting holes and the place for the printed circuit board. These are all the capacitors. Later on, I will remove the material. I will come back to it a little. Then, I have a heat sink which goes and sits and touches on that. If I just transfer

these two opening, see here and close it, now one part of my enclosure is closed without any problem. Life is easy, now please if you come back to my circuit board again kindly come here.

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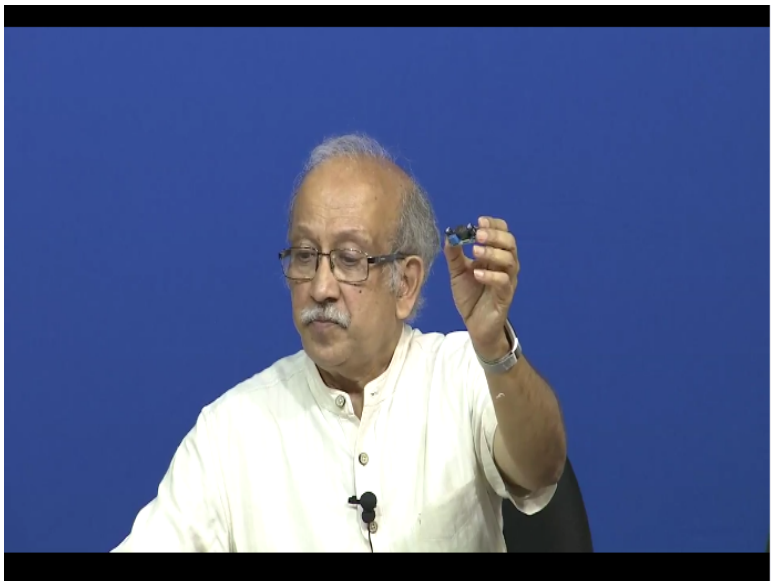

You notice that it has a small trimmer potentiometer here and this trimmer potentiometer needs access and then you see there is also a small what you call another lower portion is there. Now is there something this is where as part of the industrial design, can I build something into it to make it look a little interesting. Easiest thing that can be done probably is to play around and see what best I can do.

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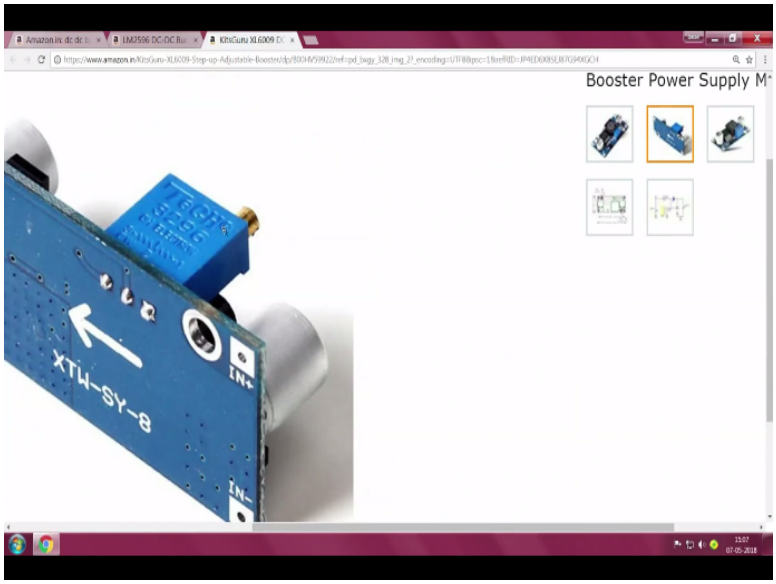

You have seen this. I have this that needs to come out. So if I make a step here and make an opening here or do I make some other thing and then the focus all the time is how the support

material is used for building up the product. Is it going to be flat or it make sense to give a small step here and then give an opening so that if I have a screw driver somebody can open the screwdriver and do it here.

And alternatively do I give a large knob by which know manually I rotate things. The inside the circuit is same. How do I build on this and this looks a little smaller? Do I make a funnel like thing? or I will just make what you call a rubber cap and I have a product which can be easily what you call printed here.

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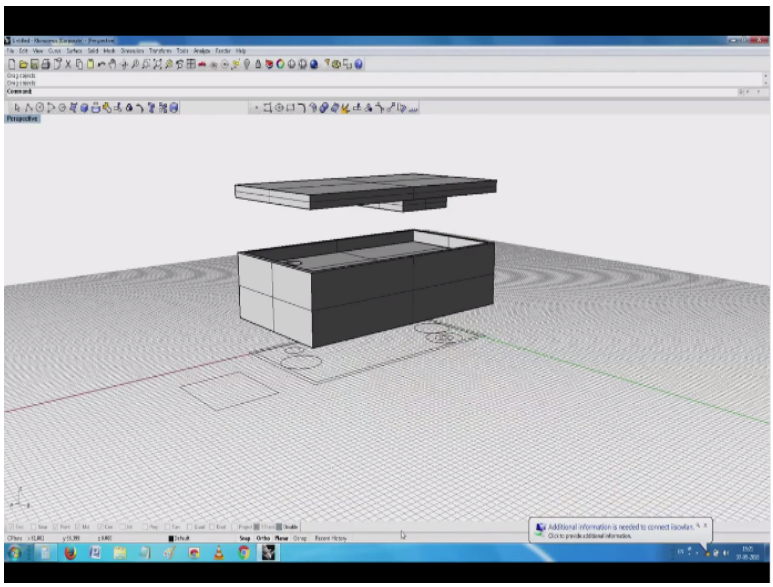

So right now I will go here and see what best I can do. Can you see this, so far we have come, this is also there. I have a provision for a heat sink, on the other side this is where now do I just make a simple cover or add a bit an element of design into the cover. So simple cover will be very easy to make, absolutely no issue at all. I just take it, extrude it, looks okay now and I make a small opening on it or do I now play around and say what best I can do with it.

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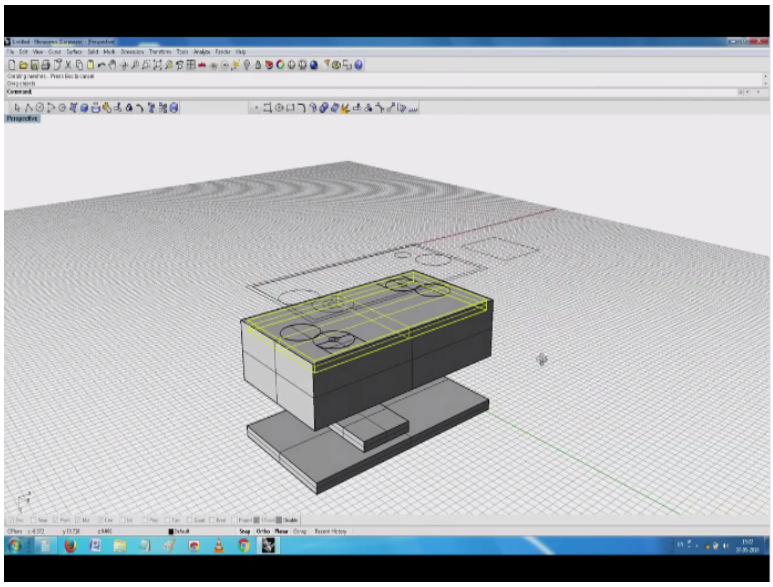

Can I give a small element of surprise in it? So I will take this side view of this small cover. Have this profile, is there something I can do with this profile? Yes, probably the easiest thing for me to do is once again start with the what do you call a line or in this case know I will start with the very interesting line like this, bring it up to here, somewhere here I noticed that, see I have got an interesting profile that I have built up there.

I mean it is not actually a gimmick but whether I can build some useful element of interest into this project.

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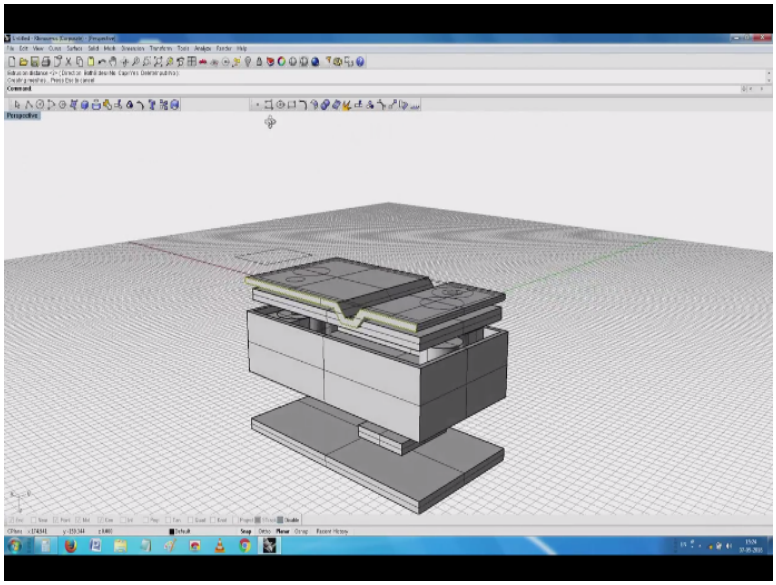

Now you are seeing here, if you look at it on the other side I have got a small step there. See instead of this uninteresting, flat object, I have got something which has got a small step in that, make sense. So I just need to provide a hole and such a thing like this is not impossible

to build. This is where that angle business has come. Now if you see the angle of this, I will just keep only this selectively on.

If you got to the machine and measure off construction, it is possible for us up to 30 degrees, 60 degrees and so on we can make the things possible. Now just to be what you call make it a little more complete, I will just see if I can give a small opening here in this. Oh I cannot say why but it says Boolean differences filled.

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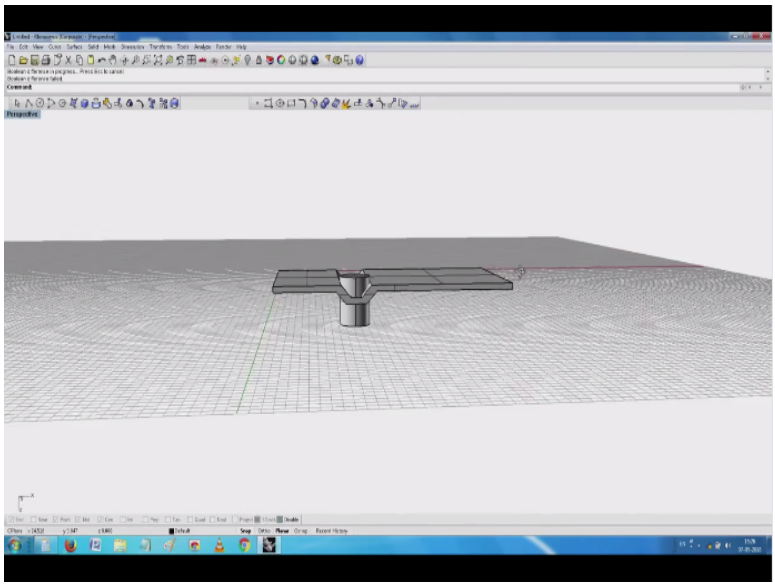

So probably there is some issue with it which I am not able to yet solve. Eventually, it is possible for me to make an opening here mostly what has happened is that proportions of that object know they are interfering and I need to do a little bit of make sure that it does not you know intercept in the inclined portion. Yeah, that could be the problem.

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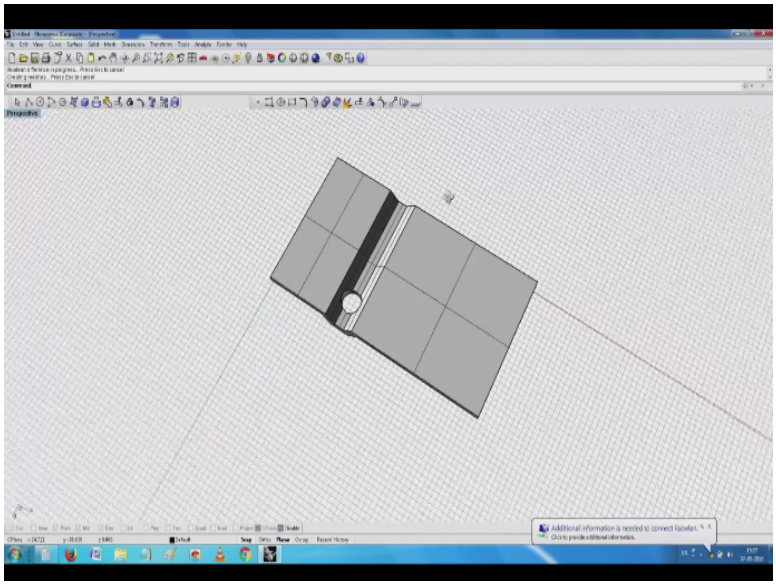

Now you see here, have an opening here, then if I unheard all the things, slowly my box is getting ready okay. This can now be happily union to this portion so that I have a nicely what you call beautifully sitting box. So this and this form one complete enclosure.

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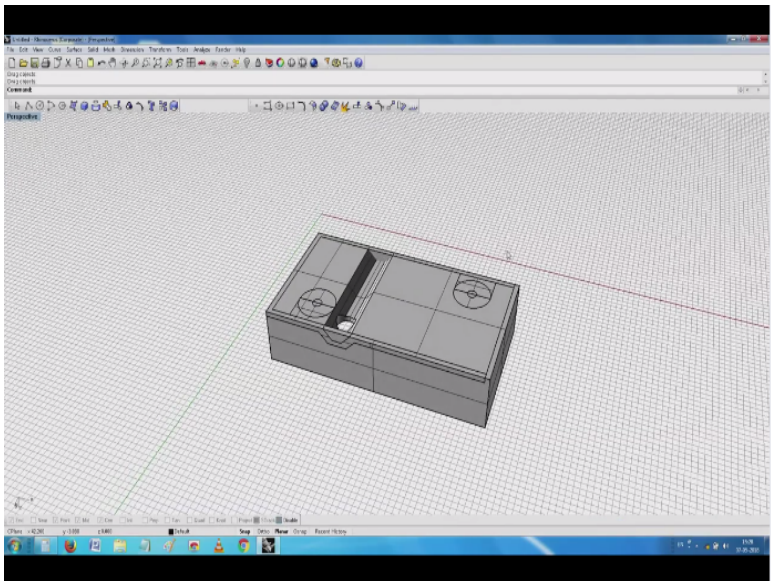

Nice, is not it? So it has all the elements of having protection and then having anything I have I just for the minute I will just see if I can yeah see have a nice box.

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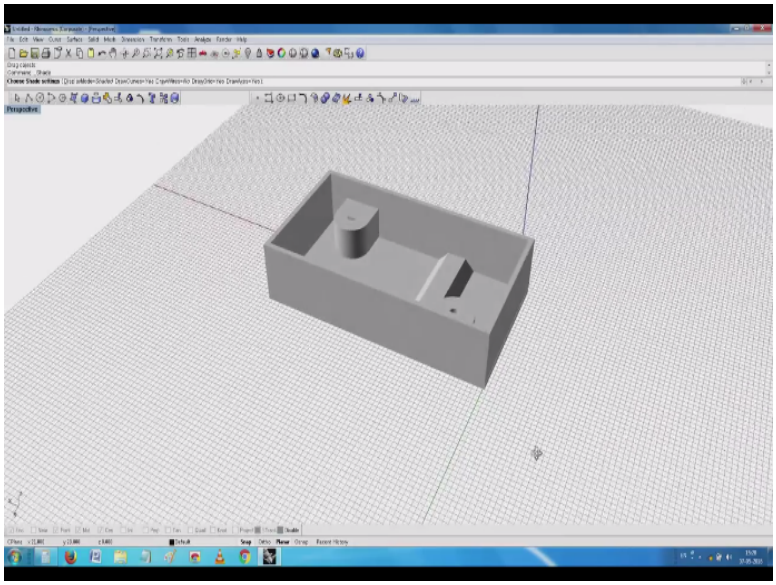

It is also protected and there is a place for me to put the printed circuit board. There is an opening there, so that I can tune the circuit and my this thing is ready. Just to make it little more presentable, I can just give what you call small edge to fill it of the order of say 0.2 mm. It has failed, sorry, oh sorry, yeah finally it is here.

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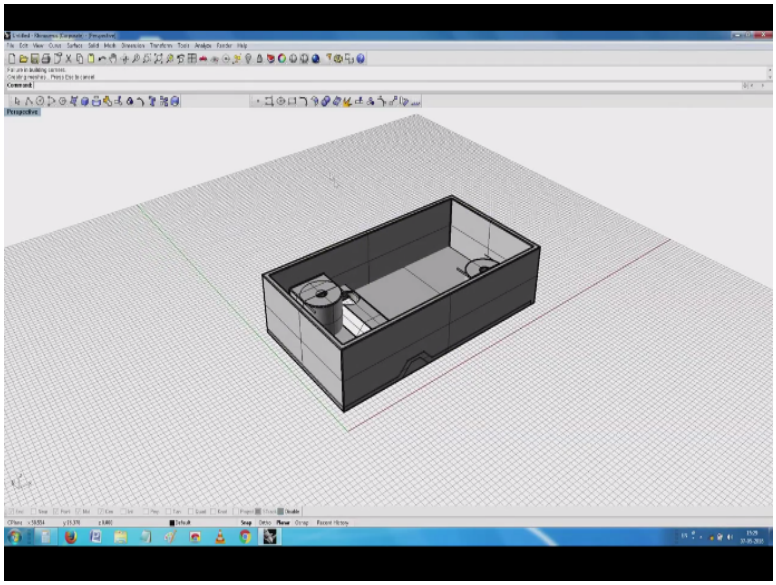

Now if you see this object, this is likely to be slightly better this thing. You have seen that, all the elements have all been covered. I have a beautiful box and then even if you see small detailing here inside, it looks fine.

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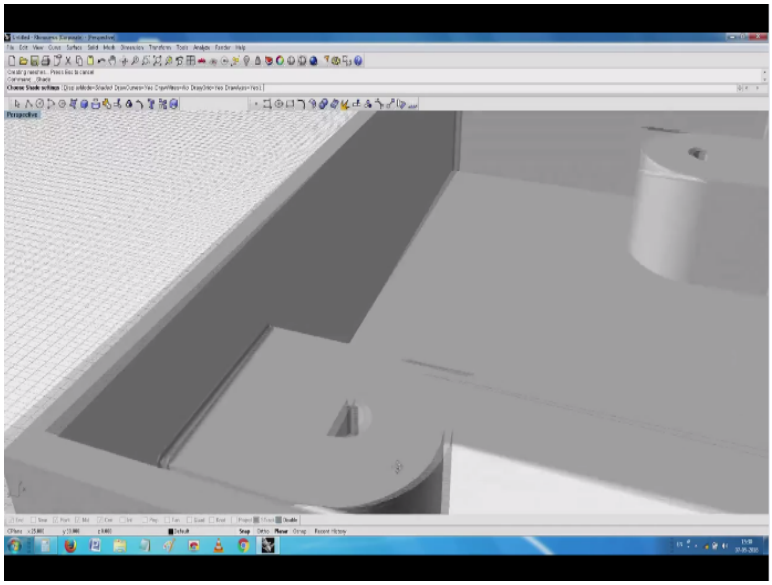

See in this and now we can just print it, only one small thing is this has been done only to make it visible and you know convenient to the eye because the edges know are the ones that catch the highlight and you can see the object. In reality, any fillets are a problem in building up in rapid prototyping. So you generally do not give fillets.

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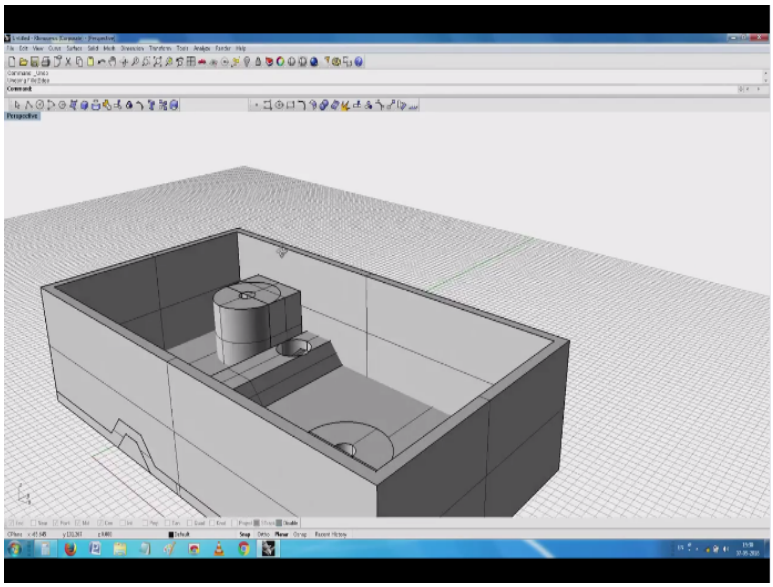

This is going to be the final object and now if I switch on all the other hidden objects also, I have a printed circuit board which goes inside, I have this heat sink and the whole thing is a product now.

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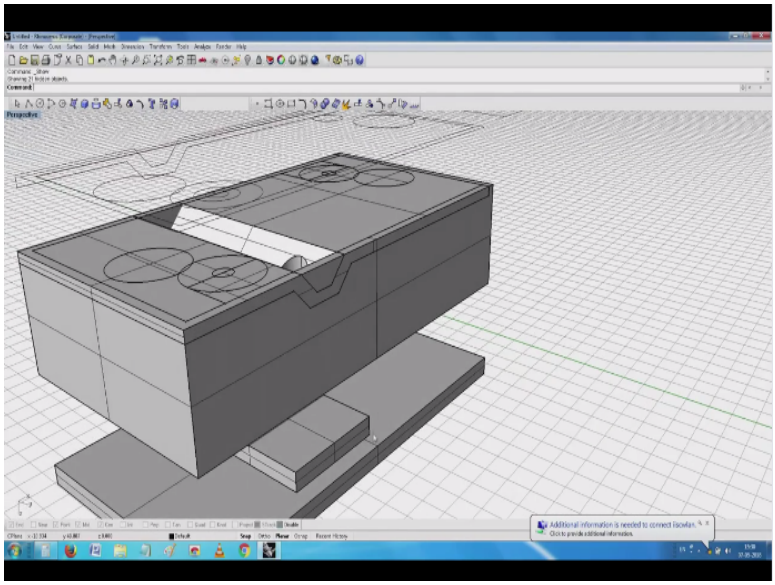

Now this heat sink, again how do we do it? Do we use some other way of what you call making or anything that is up to your thing? So I will stop here. We will meet again, so thank you.