Physical Modelling for Electronics Enclosures Using Rapid Prototyping

Prof. N. V. Chalapathi Rao
Department of Electronics Systems Engineering
Indian Institute of Science – Bangalore

Lecture – 18
3D Design 1 from Photo Snap

Hello, let me continue where I got what you call rather I broke last time. This is all about 3D printing and as I said when you want to make technical objects the issue is not simply about how to create an object out of your imagination. In this case, specifically everything is addressed to something has to be muss manufactured, something has to fit very well. So last time when I left you I left you with these 2 small circuits. So I will see whether going here will help.

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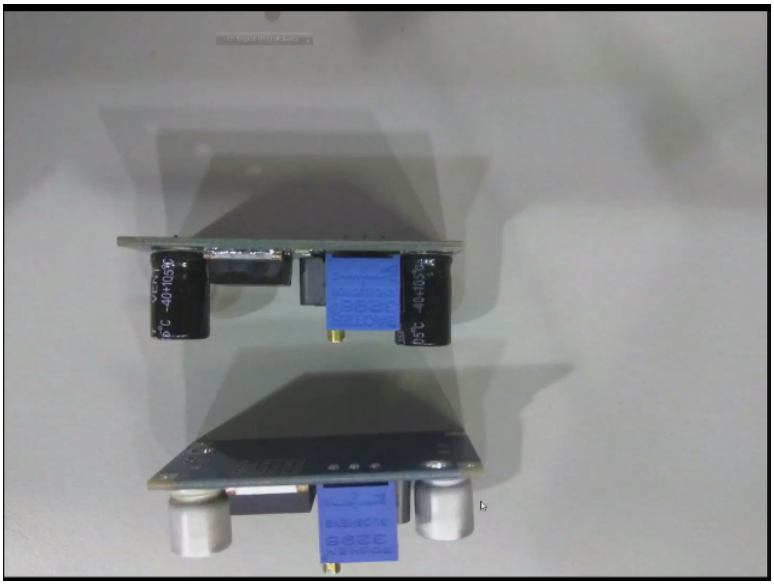

My friends have been good enough and you see this.

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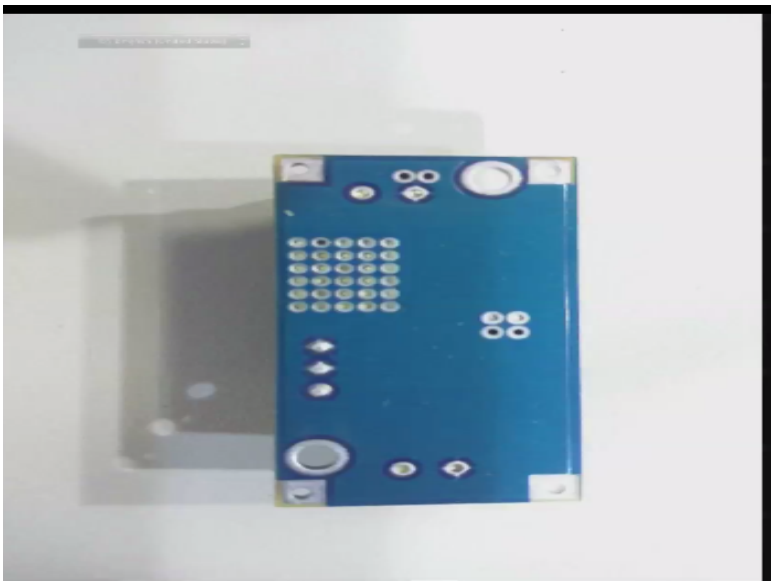

These 2 are the printed circuit boards required for a DC-DC converter.

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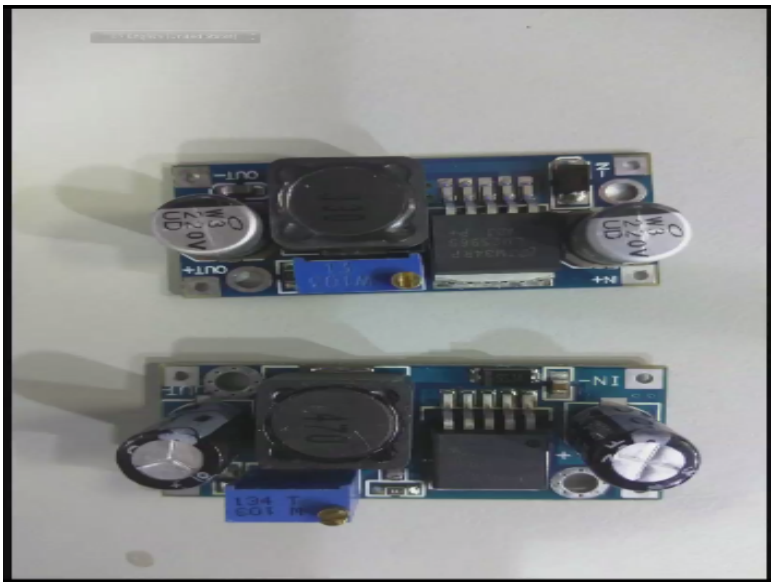

While on the outside they look a little same.

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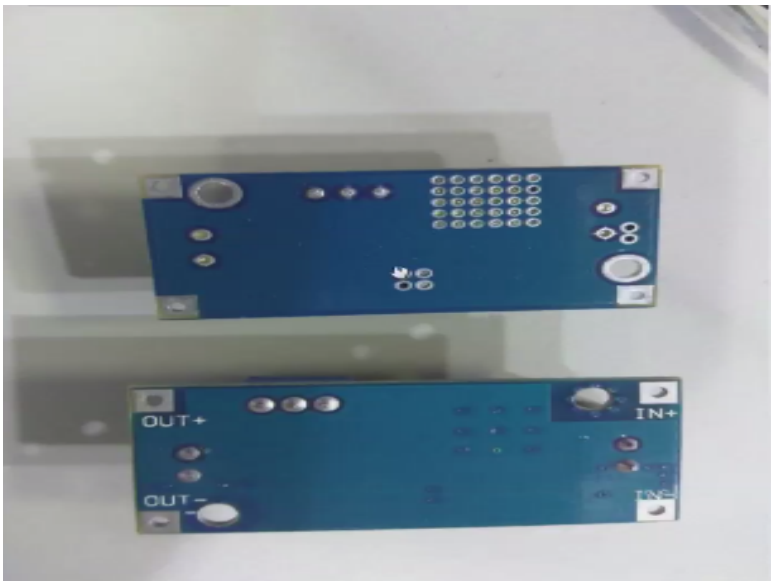

Something else you notice is that they are not the same as we think they are why? I keep repeating kindly what you call bare with me saying why this repetition but then the issue is about that on 1 side, while they look about the same see here.

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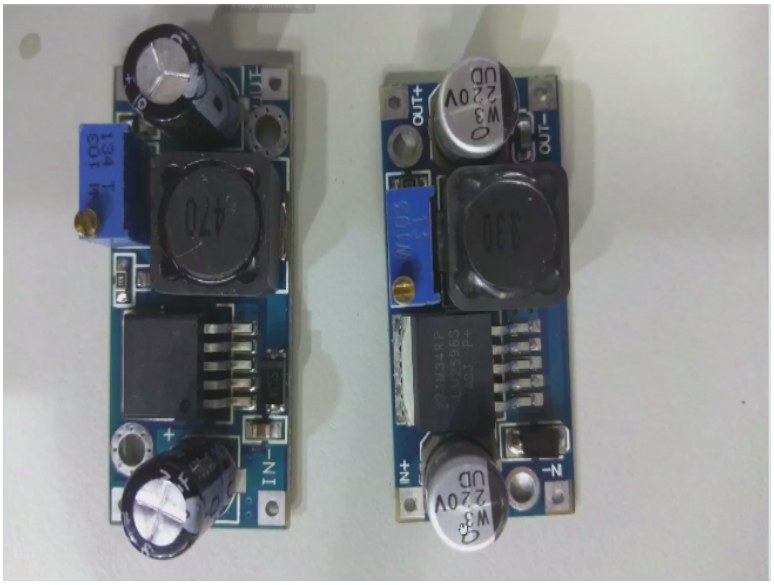

From the outside all the components look the same. We have a inductor obviously that 2 capacitors here and these are slightly different capacitors only thing is the basic chip 2596 is probably the same inside and then they see there is a number here and then there is a 10 turn point and most important which in case some in you have missed anyway.

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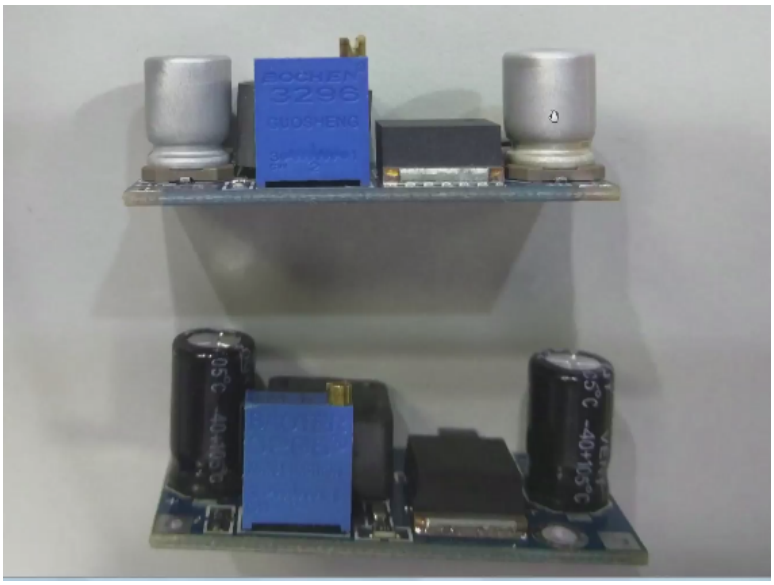

I won't let you forget it so easily is that this print is very, very different and something related to this is the component build up. Have you seen here this one looks like this top surface is made flush so that if you were to make an enclosure and it sits inside it needs to be flushed this is what I was showing you. Earlier the one I had showed you I had made something for it where these capacitors are higher and then there is a small depression here.

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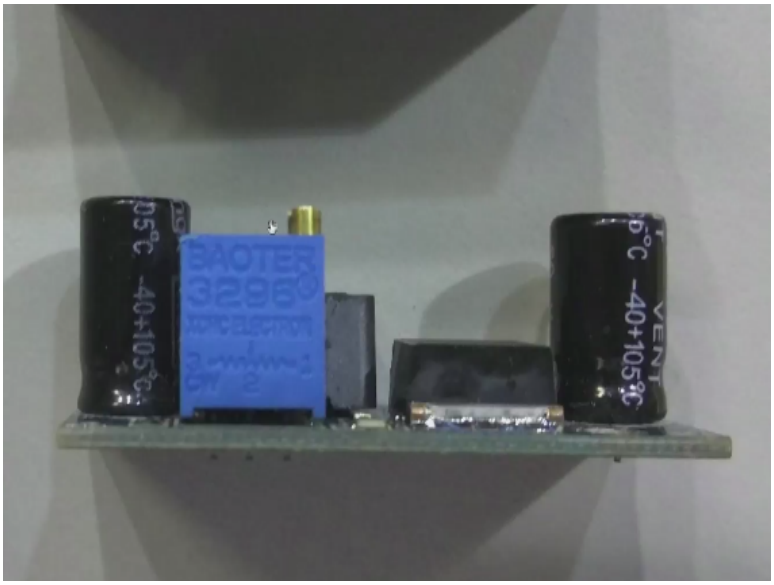

Now coming back to the, I will see whether you know the other one is you have seen here this is that is that one here if you see in the side view this is depressed compared to the other one.

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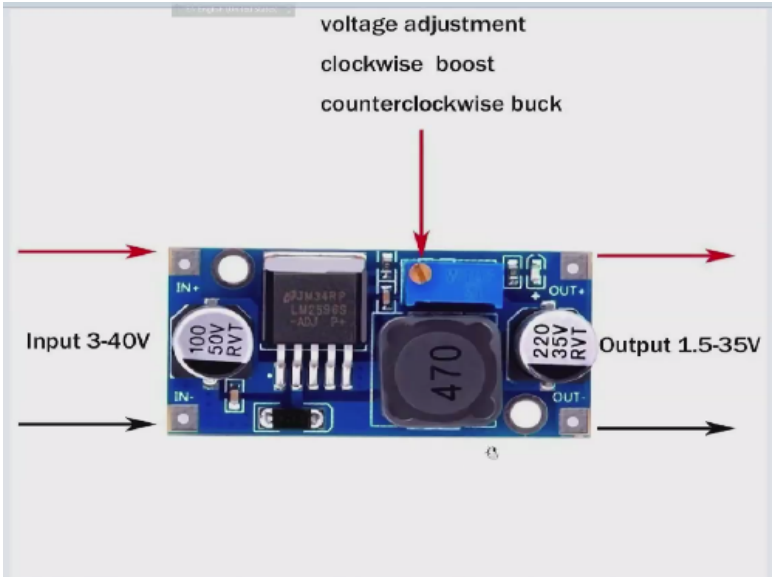

This picture what we have given here is about just seems to be other way it is not about the type of capacitors we have here, but it is about the type of the mounting holes and then how do we go about building circuit for this. You have seen this where the mounting holes are in 1 line while in this circuit there is a slightly a different you see here this is not symmetrical though it looks a little like an object that could be made symmetrical definitely not symmetrical.

You have a small what you call because of the various things are trying to make it small they have pushed one of these holes here and then another thing is this is exposed so that you can have a heat sink built into it. So I think I have already shown you this and I would like to show you this comparative thing 1 more time. You see here while it looks symmetrical layer this is not at all symmetrical. See this one is here so with the net result is the PCP has been made a little smaller.

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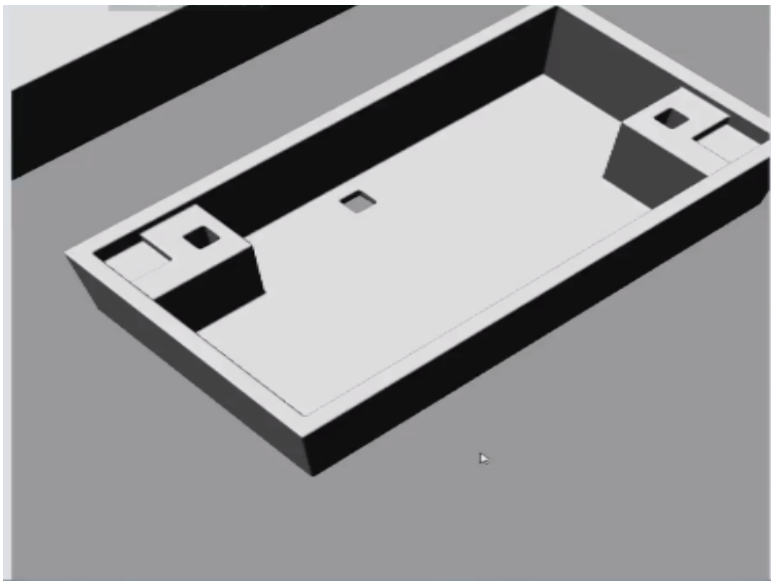

Now I set about trying to see whether I can make an optimized enclosure for it. The next small exercise and hopefully when you go back for the printing we can see what it is.

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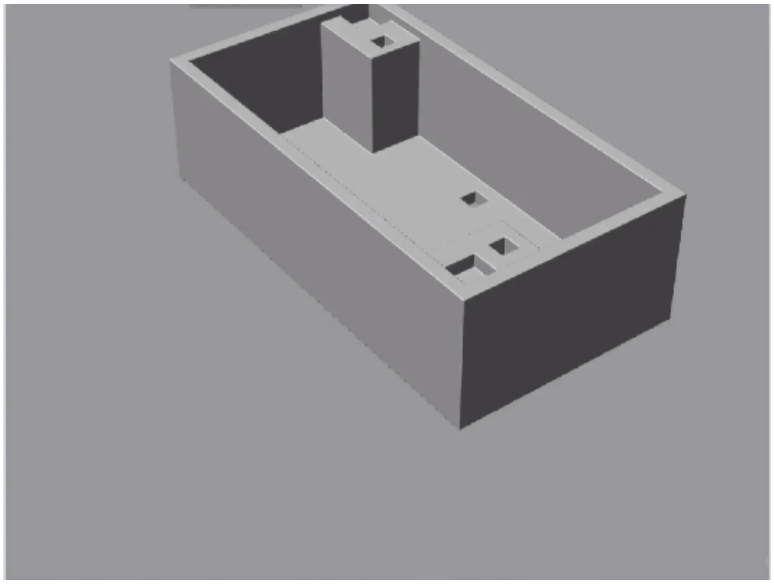

Do you see something very what you call a little I do not know either I should say it is assuming or?

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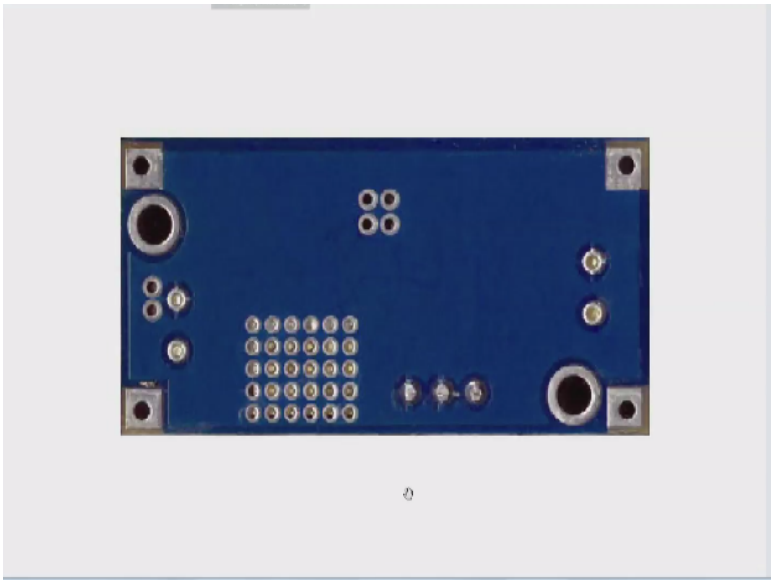

See what has been done here is to maintain perfect dimensions and make a 1:1 representation a picture was taken normally this is where you have a little problem. If you noticed all the pictures that are taken earlier they have a perspective issue unless something is flat, you cannot take a proper picture. In this case it does not just about being flatted it is about being also aligned perfectly because we want to make sure that the dimensions fit properly.

Otherwise we will end up with a very complicated unnecessary. You have seen this. I have a beautiful picture how this has been made was because since we have the printed circuit board and then it is not populated on the other side this is I am sorry it is populated, but it is not from lead through whole system the other operation is clear. It has put on a scanner and scanned. Advantage of doing this is now I have perfect location of these 2 mounting holes and then something related a little related to this is I have 4 places where the soldering can take place.

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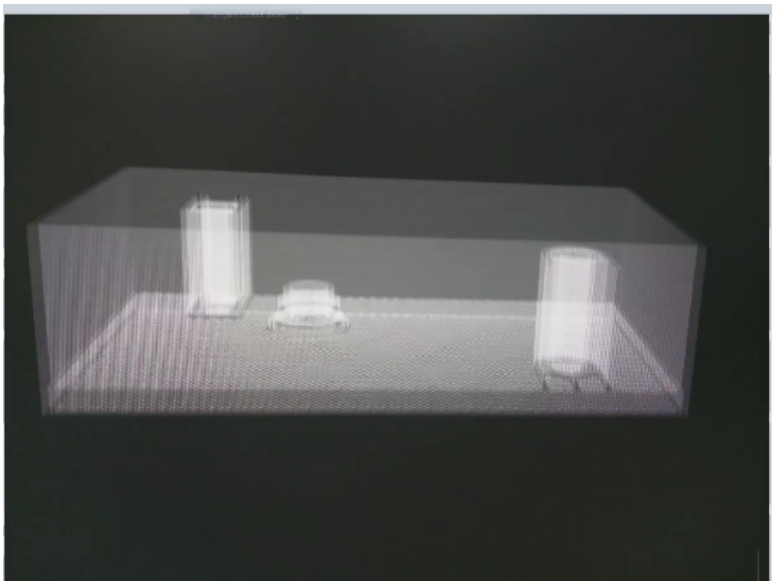

And this is slightly different from what I showed you yesterday. What I showed you was this you see?

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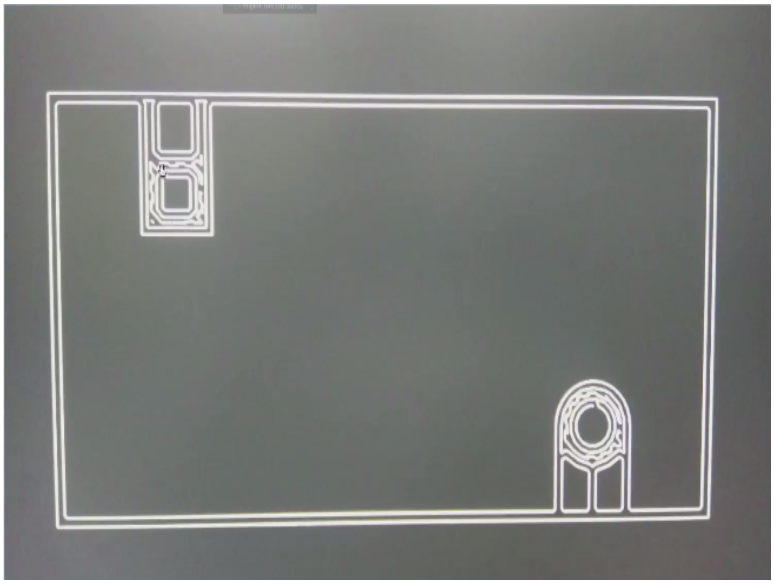

Here I try to make something which a square opening here and then we have some other thing around opening here and then just to show you how the buildup starts, how the material builds up and all. This is sort to be recapitulation or what we started. So this is where the starting what you call.

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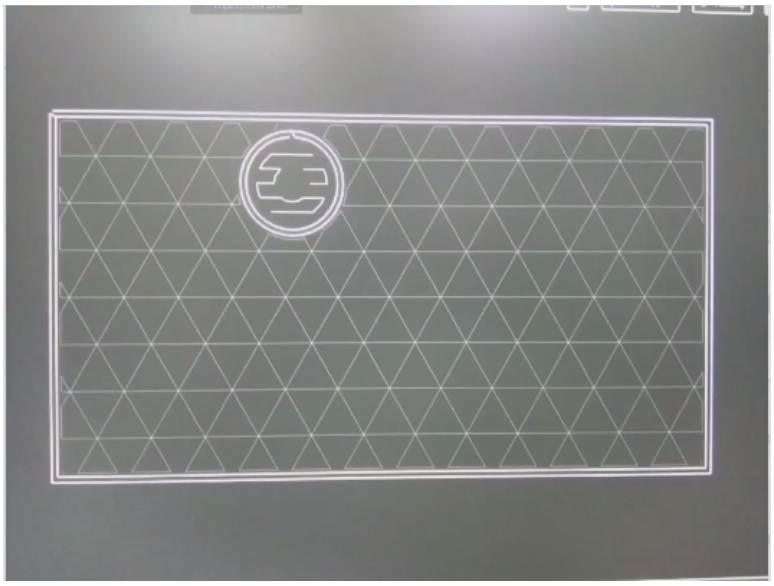

This is support material hexagonal matrix like thing that has been started and on top of it the building has been done and then if you see that continuous thread that is all the material it is inside.

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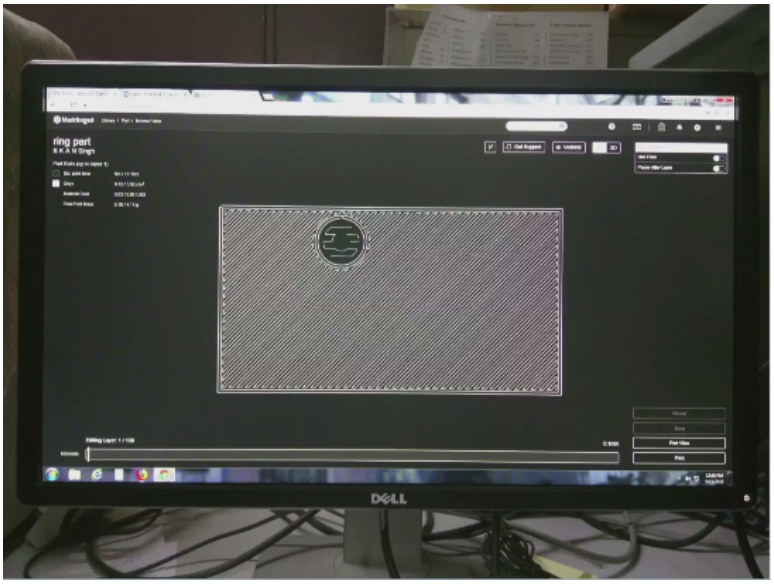

So if you see this, this is how the whole thing progresses and if you get a chance and if the machine is free I will see whether I will be able to build something for you.

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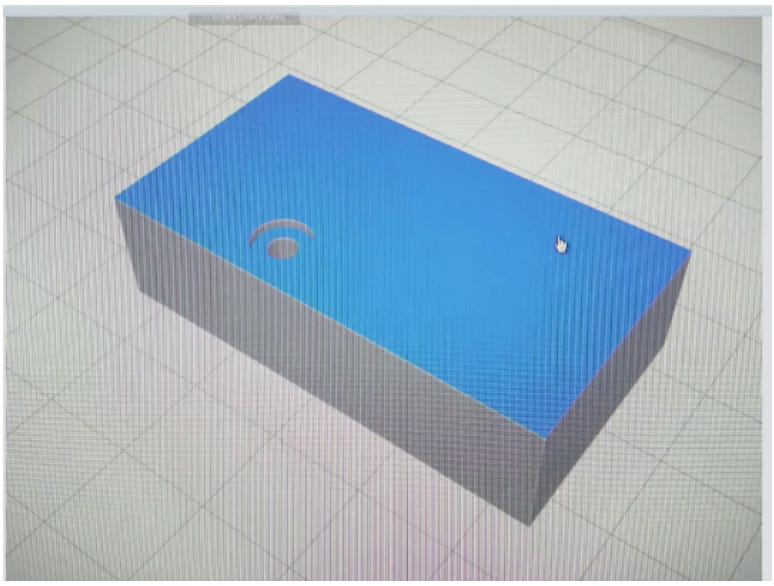

And only as starting point yesterday I showed you this thing.

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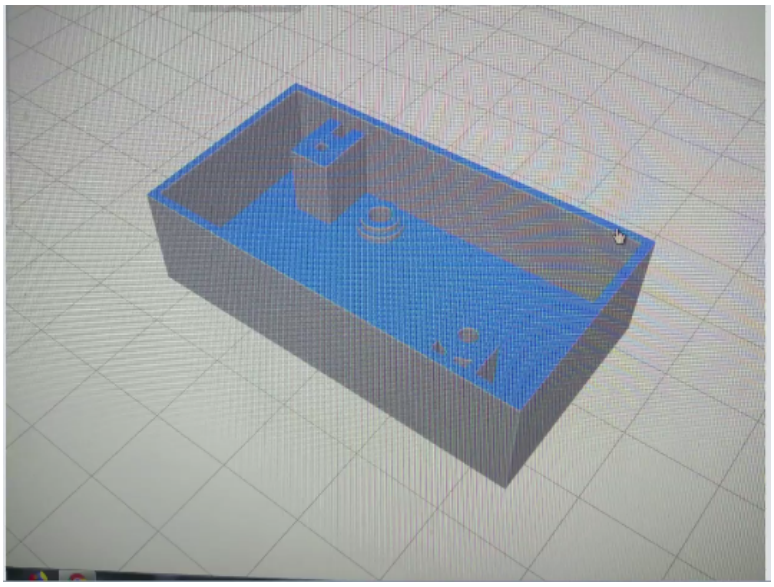

You can make a box here.

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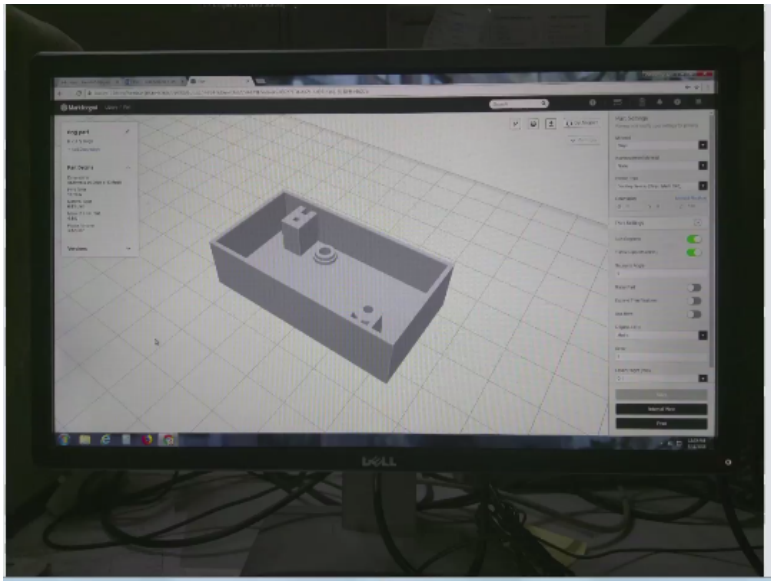

And I even made a step there to see if we can optimize something. Now today, I will go away from here and show you some other way of how we can build and another enclosure.

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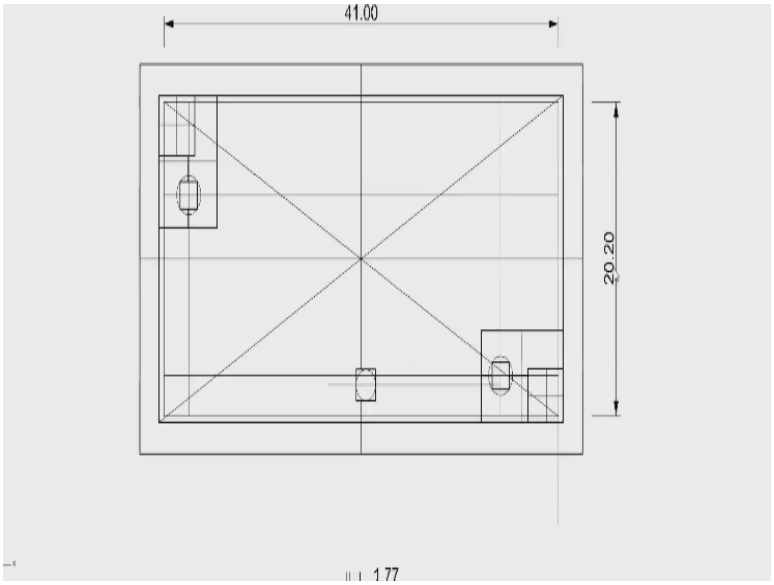

See the starting point for this was as before if you see here kindly have a look at my picture here. If you remember that scan picture has been put on we have taken a print out of it then we have taken the actual piece which needs to fit here and I have asked my colleagues from the workshop to measure and jot down all the correct dimensions, perfect dimension. If you do a mistake it will not fit and then earlier, we could effort to make things.

Because there was always an issue of tolerances and fit and all that in this case it will like to be as close as possible so you have the; what you call this is the printed circuit and this is the scanned and printed object. Now, this object has been taken and placed here in my.

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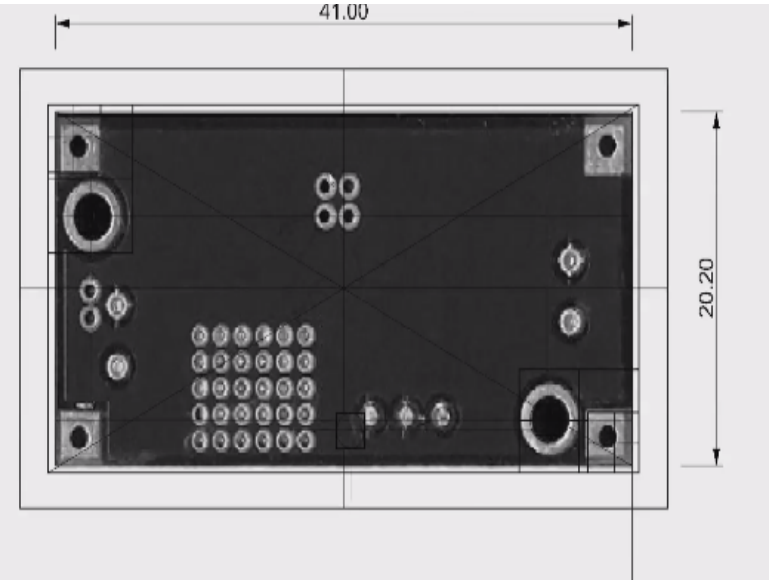

I have placed it after making a rectangle of the correct dimension. I have rectangle of here if you see I have a 20 mm x 41 mm rectangle was what where the measurement was made. And the whole thing has been kept at the back of my, the starting point of my what you call enclosure design and you will notice that because of the what you call you want to make things a little small and all that I had just given the absolute minimum gap that is required and then which is still integral with the machine and its resolution.

So in this case it is does have you know 1 side it comes 0.4, other side 0.5 mm and I have a very good starting point to start. Now if I hide my this what do you call tracing bitmap it is a very good starting point for me you have seen this and you have seen here I have a circle which represents the center point of the hole and then the hole arrangement outside so I have a 20 mm x 41 mm rectangle and all the various openings I want have been constructed here.

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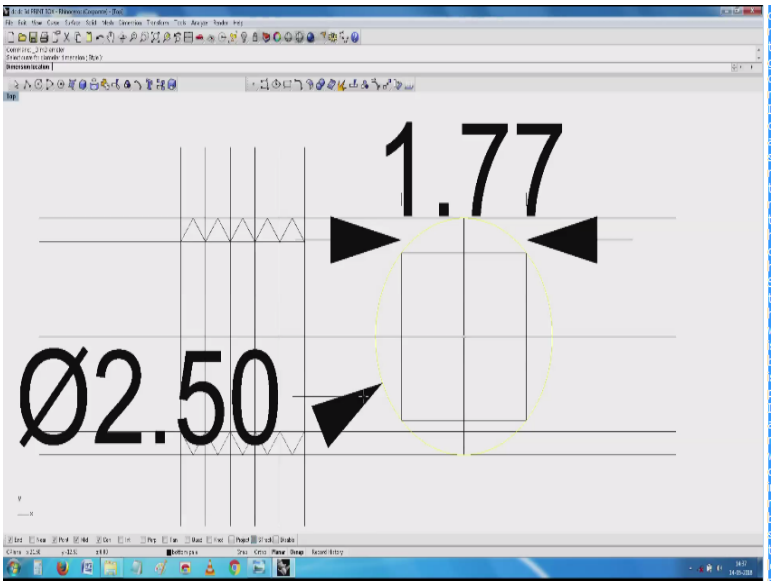

Now if I go actually trace it here something else I have done here. If you see after checking I had to go back and see what is the opening that they have given in the circuit board? The hole that has been circuit board was a little more than a 2.5 mm so it may be 2.6 or so that has been found that if I keep a 2.5 mm screw it goes through very well. Now I look for a way of how to attach it down.

As I have explained as we explained slowly it will come together I have put a 2.5 mm screw and then going through the metric standards I checked and found out what is the pitch of it the what you call ISO and our the pitch in this case are actually 0.35 mm so based on that the whole thing was constructed and comment on a optimum shape of a hole.

The outer most represents the 2.5 mm so if I go and try to give the dimensions here I am sorry it is R I think I need to pick up the diameter. It is a 2.5 mm hole. Inside the 2.5 mm hole the 2.5 mm nominal diameter in the case of our metric system the outside diameter state is 2.5 by various what you call actually it is a by a little trial and error something between this root you were to fully make a what you call a pilot hole and then try to drill a pilot hole the pilot hole would have come to that level instead by.

Because I do not have a provision for that to sit here what has been decided is I will attempt a square hole which is a little smaller than that so that I still get something which is not bad so the

pilot hole comes here I have tried this square hole earlier and I have come to an approximate size which is 1.77 mm. This has been the basis and starting point for my design here. You see here now this is where I need to take a very interesting what you call build up about it saying if you look at this printed circuit board which I have shown you earlier one of things you will notice is that is the one I am trying to build.

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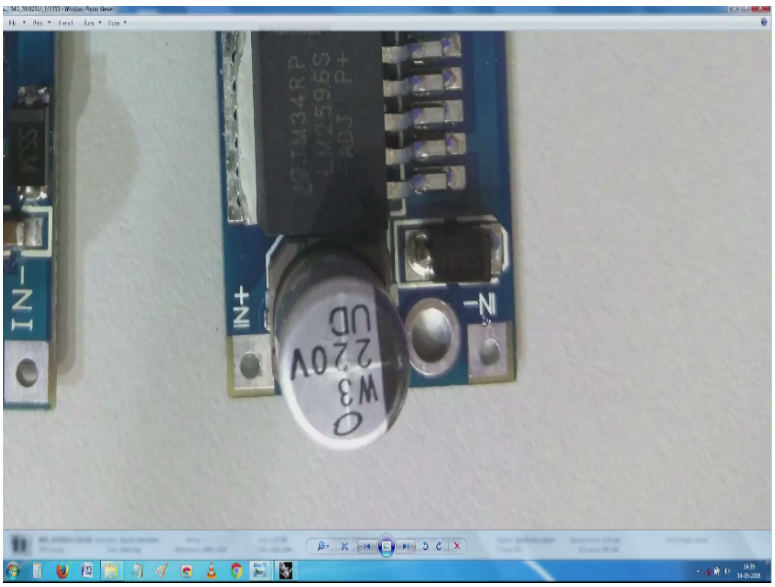

See this small detail here. So I need to support a hole here and I do not have much place here very little place is available for me same thing on this side also. If I come close you notice that this surface mount device capacitor is the limitation the amount of space has surface mount limitations. Similarly, here I have a small SMD another tiny I do not know probably it is a resistor and within this is where I have to support this hole.

So I come to the what do you call the dilemma saying what do you do now so I have decided provisionally to make a square starting from here going all the way from here to the other place and then what do I do about this what do you call outside soldering. I have decided to relieve that thing to a small step. So I end up with a square what do you call consider a rectangular piece which can go and attack itself to seen this here.

Now I will unhide these items. Now you see here I have a box and this whole thing is attached here and the square this corners represent the holes in and out openings like that. I have this issue

of having to worry about it only at 2 places here and there and at these 2 points it is not a big deal at all because there is nothing which is occupied in this.

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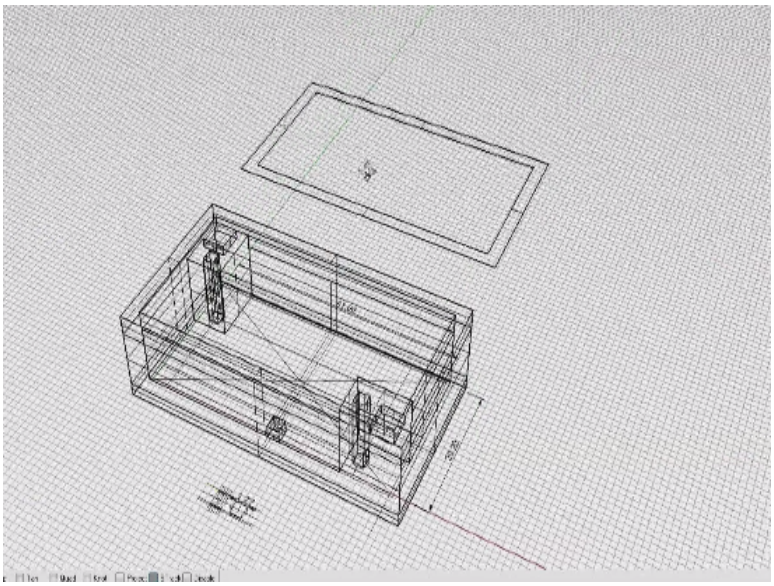

So now if I build best on that I will have a beautiful enclosure which is built here.

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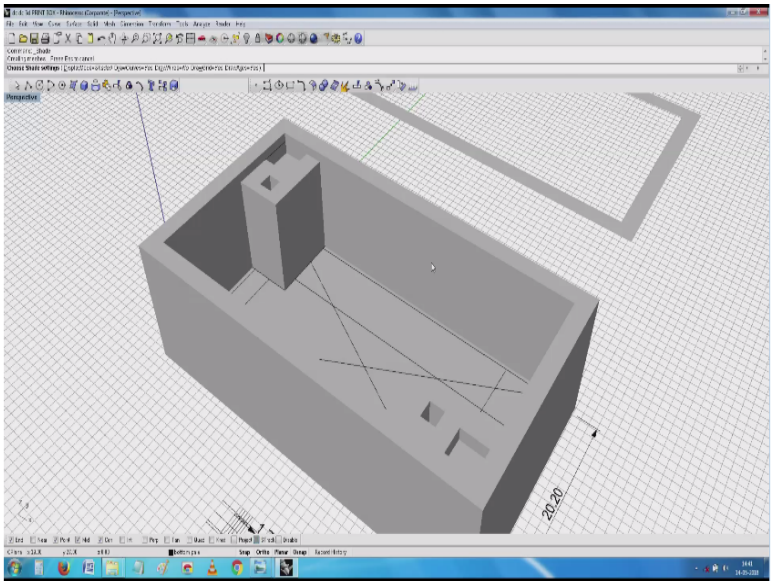

Seen this looks like it is very, very easy. Depending on your patience and so on I would like to still show perhaps in case you are interested only in case you are interested on how this whole thing has been built up. In this case it is very, very easy.

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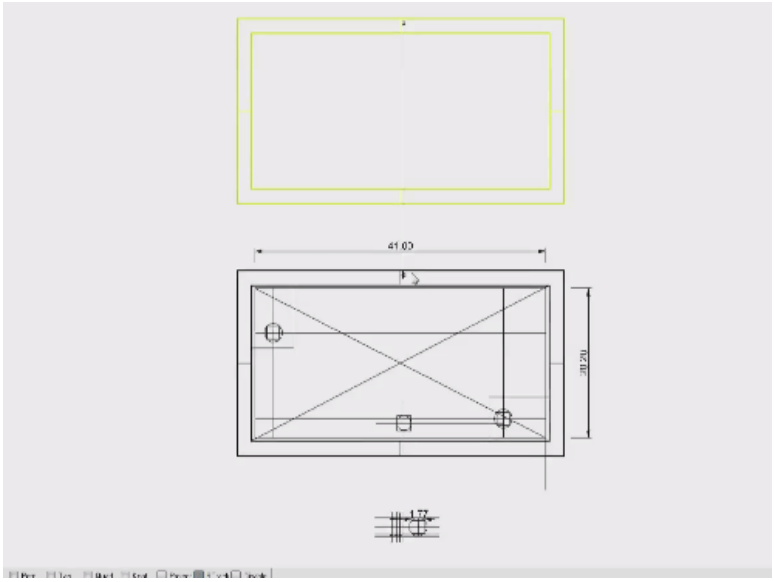

I have a box this is the box which sits here nicely it sits here and then it has been converted into what you call a piece like this which can be happily extruded this being a it is a cinch; with too much of an effort I have a beautiful box getting ready.

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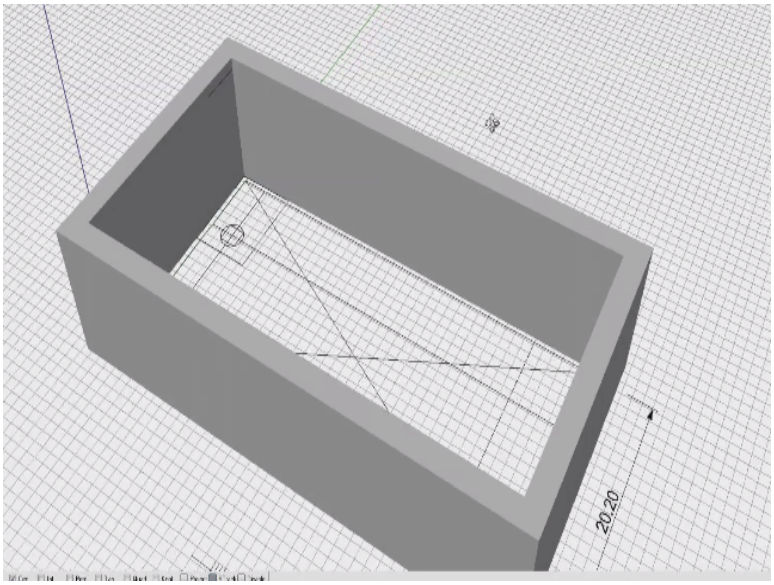

So I have it no problem at all and then if you remember in this corner I have created something else here in this corner. See here this one. Same way I just need to extrude it out interesting very easy once I get all dimensions and all ready making anything like this is extremely easy. Now we come to the other 2 points saying I have 2 small square holes which need to be made I do not know what to do about it somewhere it has got locked you see here.

At the base of it I have the small square hole. So I have similarly I have this another square hole now I try my best to take it up and see it is really, really a cinch. I have got this life cannot be what you call easier than this now if you remember that corners I still have the issue with the corners saying somehow I need to make a place in the corner. I do not know whether I have the information here or may be information is lost, but still nothing is lost as such.

For me to give small relieve in the corner it is very easy for me to make a small what you call solid, a box see I have got this nice box which I can use for removing material. I will copy it again here and see whether if it is a symmetrical object it will full for me. It is useful not very symmetrical maybe I should rotate it.

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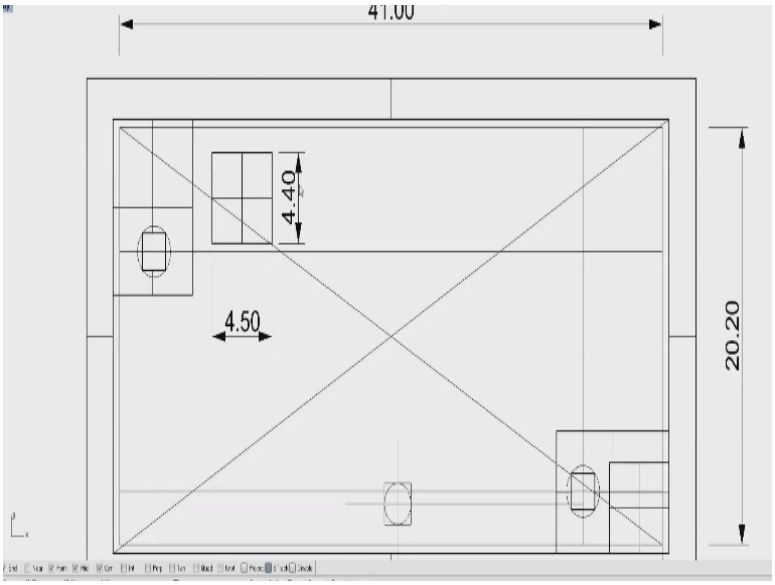

It is symmetrical who said it is not symmetrical. 4.5 millimeters, 4.4 millimeters not bad so I will just like that I will take it here.

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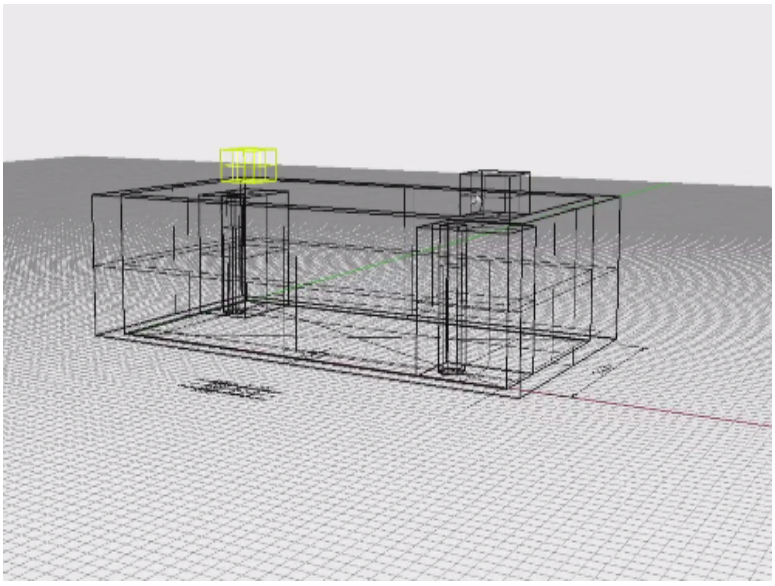

So right now looking here so in this I have been this small thing on top I will now try to use and try to make a depression on top and.

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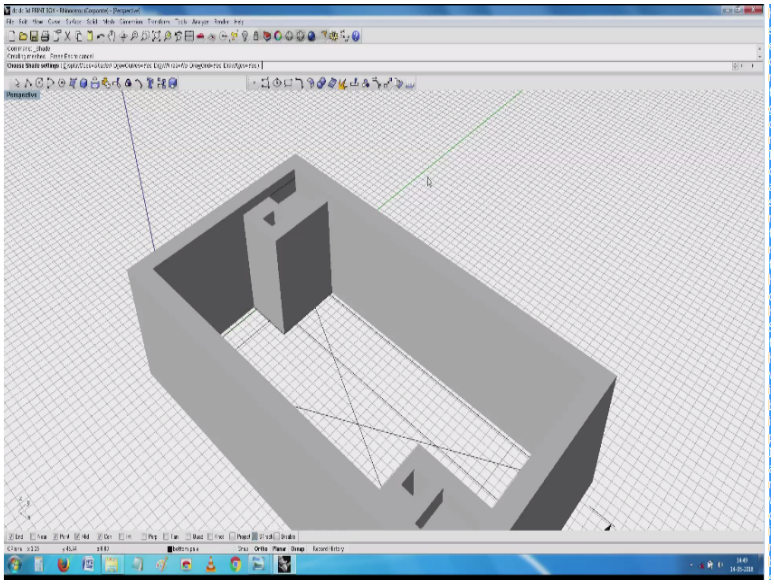

So I have a beautiful what do you called device which is ready and I need to do something to make sure. It works properly only thing here is that at this stage I try to stop it here because this can be used for both types of printed circuit boards were made in what you call I call it parts so that I can use it as a universal thing hence forth. You have this corner support I can use it for any printed circuit board I have which involves a similar type of a thing at the corner.

I can just put it and make a relief and so on. One thing you will notice is no detail has been shown here or has to how the wires will be taken offline that one of the best way is probably it would take you think here and take the wire here or depending on what it is not normally that is what you will do here we will take a small cylindrical shape here somewhere in one of these places and then I will see if I can make a solid which is typically a cylinder.

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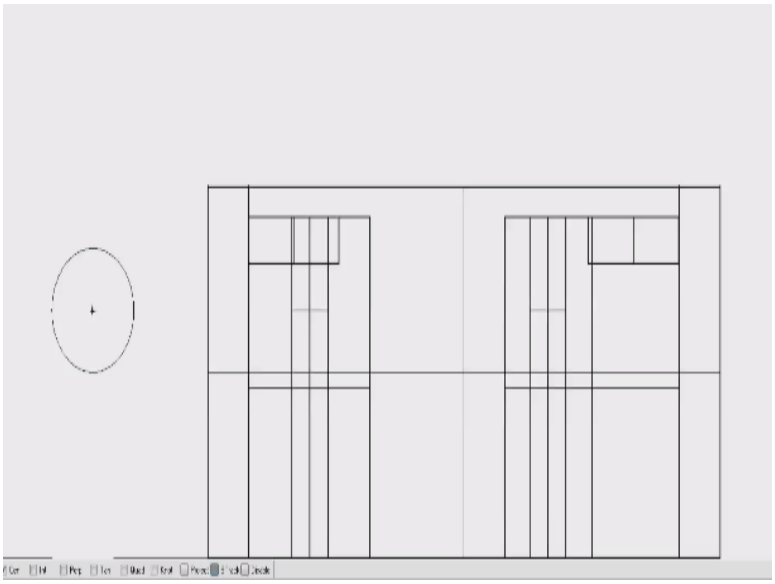

In this case in this view, I would like to make a cylinder which is typically if I see here it shows this is a 2 mm hole just slightly bigger hole.

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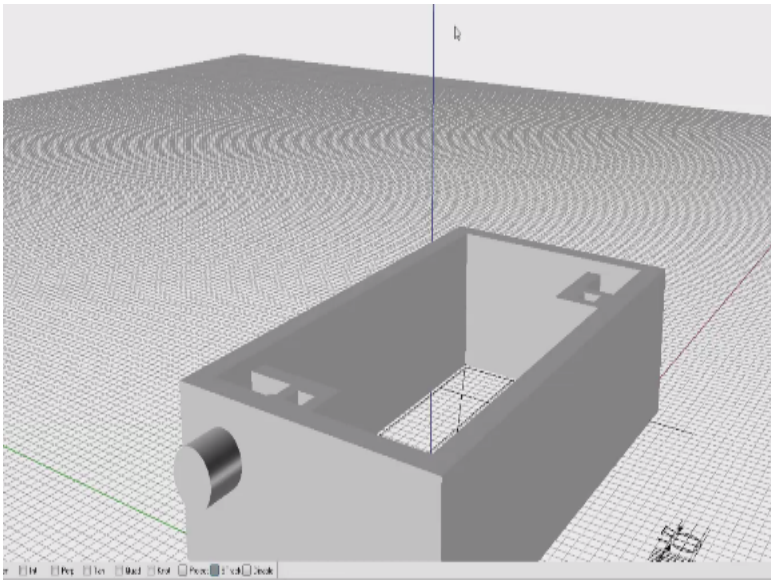

Again going by the same earlier, sorry do we need to make if you make a circular hole where it is convenient and the wires can all sit there and all that we still have the old problem of when things build up how the slicing is done and how the things are build up. So it is not a very good idea to start with circular things because, we end up with a support.

And then the moment the support issue comes will come with more and more material to be stacked and so on. So in fact I can probably I can do much better without this and instead make a rectangular opening here which is very, very easy for me. So I go back here look at this try to make a surface which is a plane. The rectangle can just be this is the plane it is sitting at the bottom here so bring the plane here try to extrude it down.

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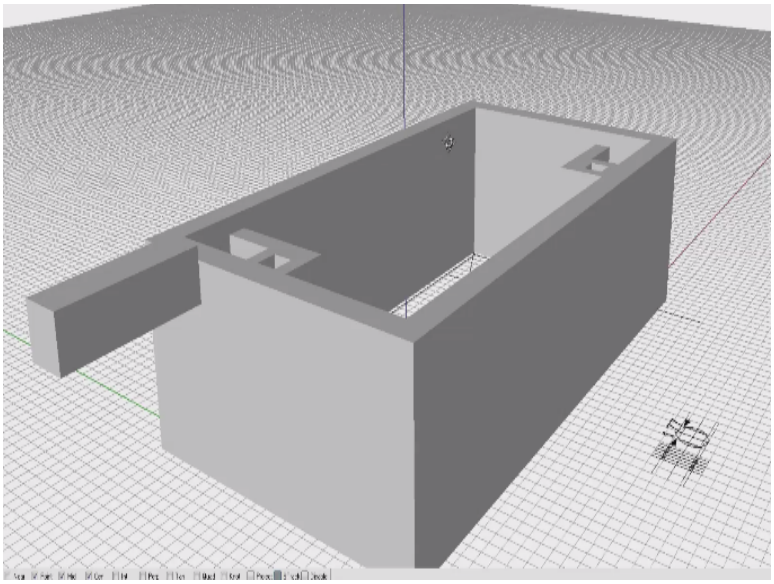

See here now I have a chance of making simple notch which is a square or a rectangular notch now I will copy this notch in all the 4 places.

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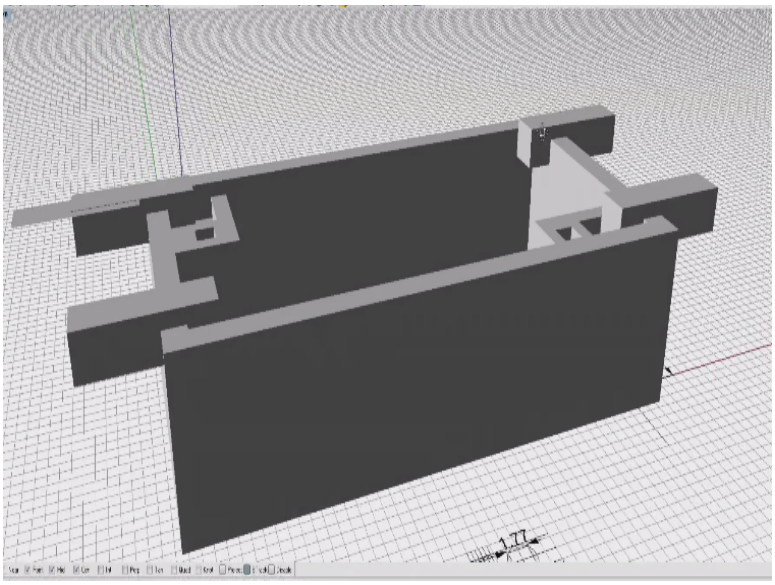

So going back to the perspective view I have managed to achieve 4 openings so it is easy for me. I go back to solid, I make a difference of my unit is almost ready.

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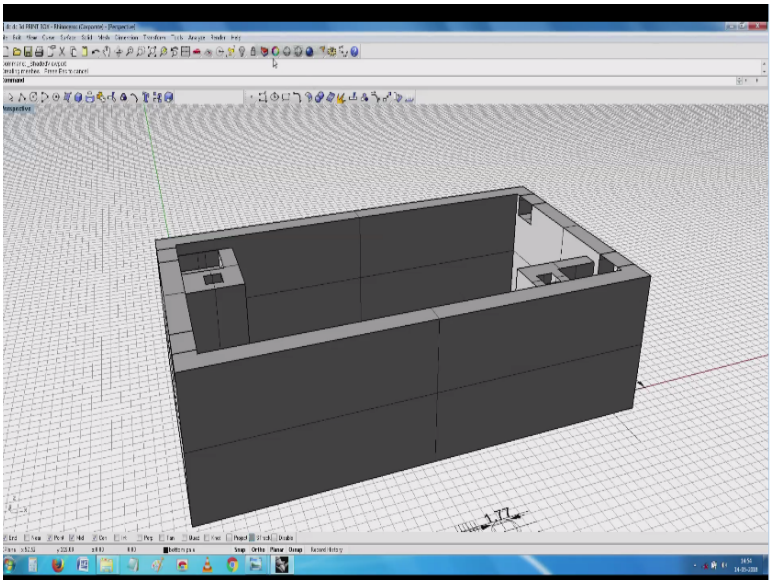

See this, easy for me. Life is probably; now if I go here and try to see what a cute object it is. Now when I want to build it depending on the way I place the components and so on it builds easily without the slightest what I call issue about it. It will start at the bottom and then slice by slice the whole thing builds up. This being square overall build is going to be very, very easy. So what I will do is I will now save, open 1 more which I have created earlier and then I will show the slices are going to be built here.

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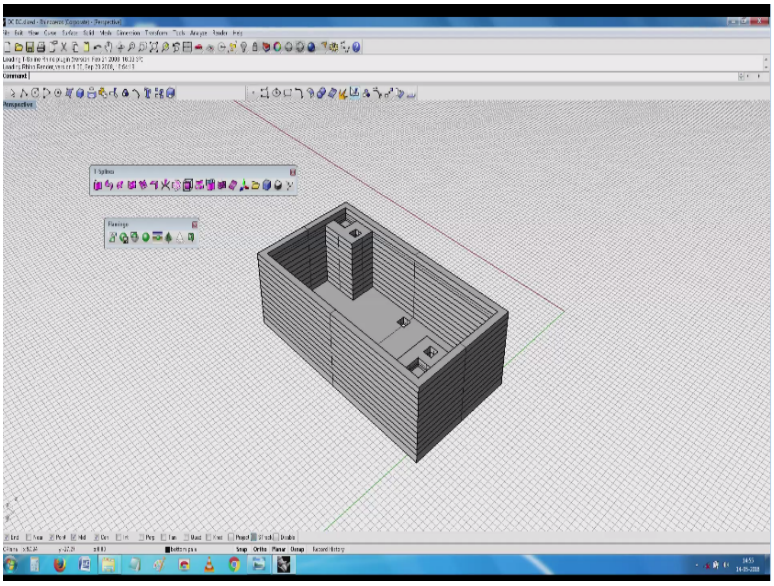

This one is a little similar to what I have already shown you here earlier expect that should demonstrate how the slices are built up I have what do you call cut the thing into the various types of slices and one after the other you will be able to see.

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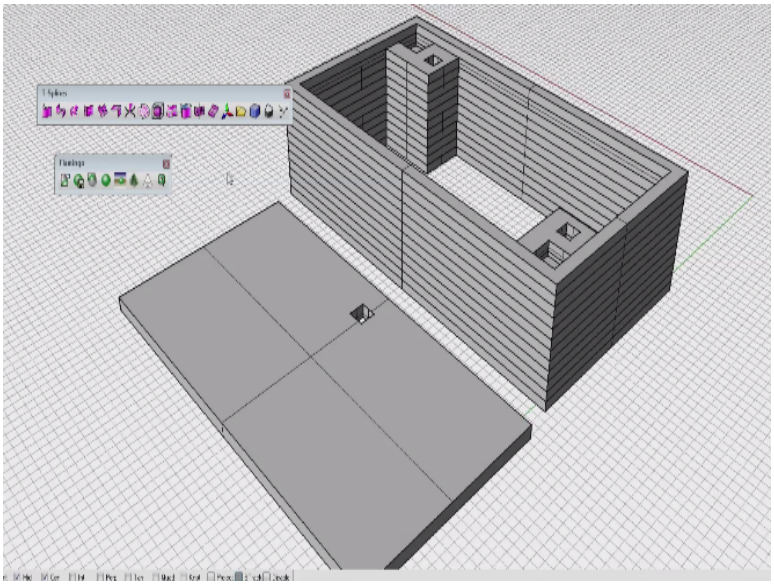

First slice the layup is going to start like this so if you see the layup whole thing will be filled one after the other the items will be filled.

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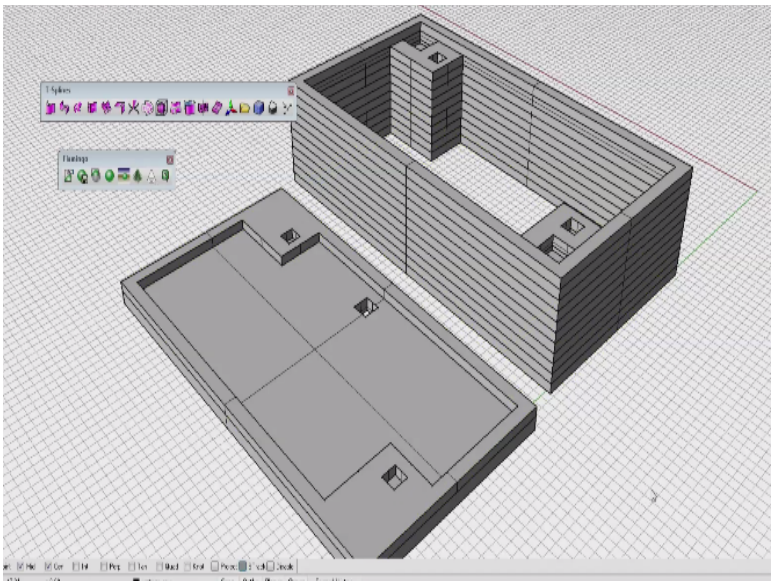

After that next one if you see already next bit of a thing is being built here. Now you will notice that nowhere there is any undercut that has been given here you understand all of these from these 1 by 1 they will all build the easiest without this latest problem you can see that the whole thing is being built like this now if I give a sorry I do not know why it is behaving like this.

You see this. 1 or 2 things you will notice is there are no fillets or chamfers that is given anywhere. The chamfering and filleting that may happen here is because of the way the layup of the material is done which is very little it is less than 0.1 to 0.05 mm. So one after the other these are all almost common so I will drag the whole thing here.

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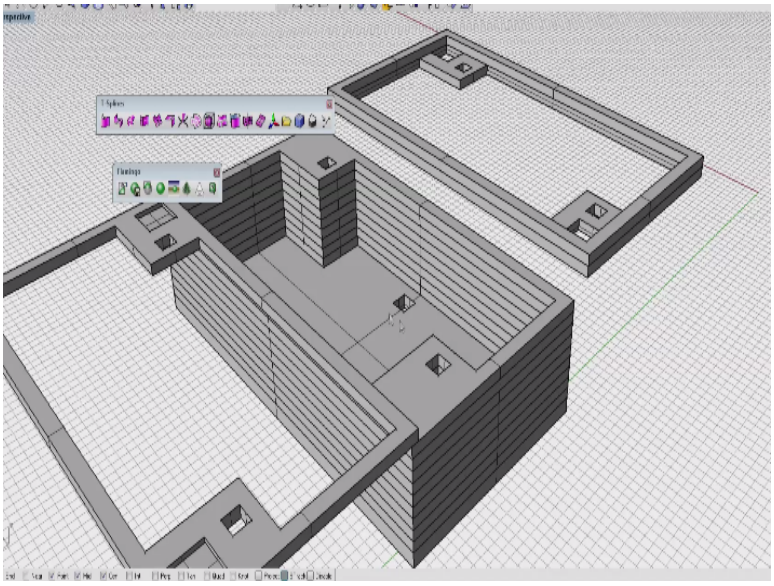

Now we come to the last 3 where a small difference there can you see here. This is a partly closed thing here. You will notice that when it lays up it starts laying up, but then about one third or one fourth of it already a depression has come here. So if you see here this slice alone is probably likely to look like this and when these slices you know build up one over the other see the first thing I have started this is almost complete the way we want now.

All the detailing that is required has already been fulfilled here and seen this we have a beautiful thing except that what is it that I did not have I did not give the rectangular vertical opening thing. I have a reason for it. One of the reasons being that, I may not want to have the holes directly here in the circuit coming from here. I won't not mind, having the circuit being see this is going to be like this and then I have a cover on this.

If you remember I said I am going to have a heat sink on top of it so after putting all these things here I will now after my trial is over I will probably the second object which I am going to print will probably have to have that saying would I take my what do you call my wires from here by drilling force holes in the aluminum.

Or will I make anything that I need to do after the first assembly is done. Second print is going to have it and in the unlikely case once I put it what I call heat sink on top of it I can drill holes on the heat sink and have these wires stick out alternatively very easy for me to file out a few what you call for openings here and may get so intentionally I have what you call left it here.

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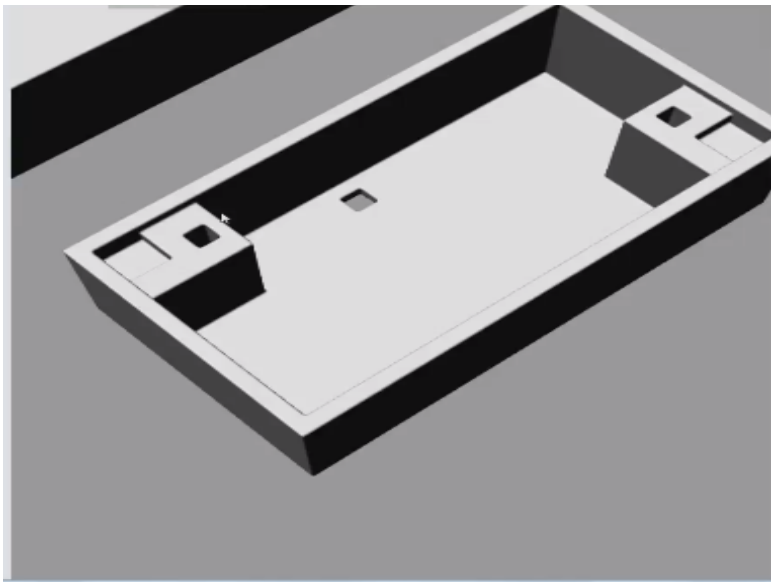

So next one is going to be this is the fairly completed we call object can you see here to make this thing interesting what has been done is I have given a small radius here. It is in our human this thing we can only perceive objects when 2 surfaces meet and highlights are caught here so beautiful highlight has been caught here because of that this object looks more real than a simple flat rendering.

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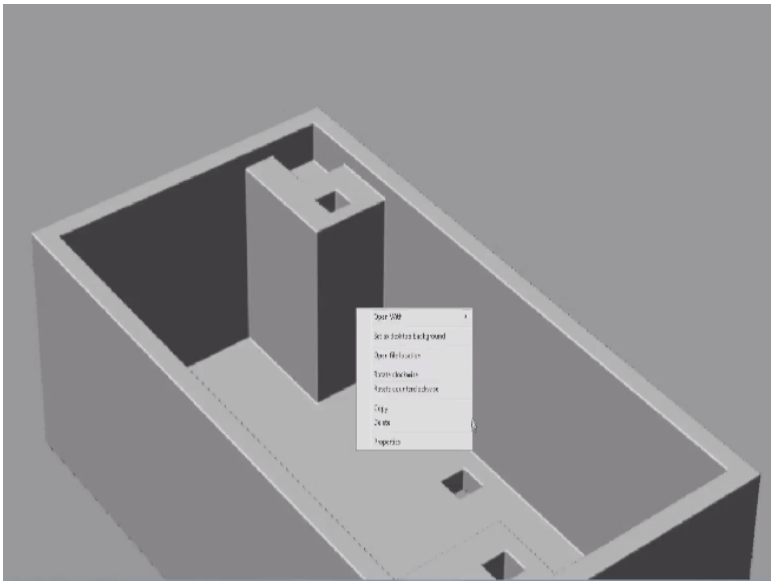

So this is a flat rendering with you see here small corners have been given here this looks a little more natural. Once the printed circuit board is kept in and then after that I clamped this for now I decide what do to with it and then other side I have this hole and then hole has been made if you

notice your compared to the all the fancy depression and all that and this object is going to be much, much, much easier to lay up.

So extremely what you call it is a tiresome for you and may be a little bit of you know tiresome for me also but you see in the end we have these if you try it you cannot be wrong.

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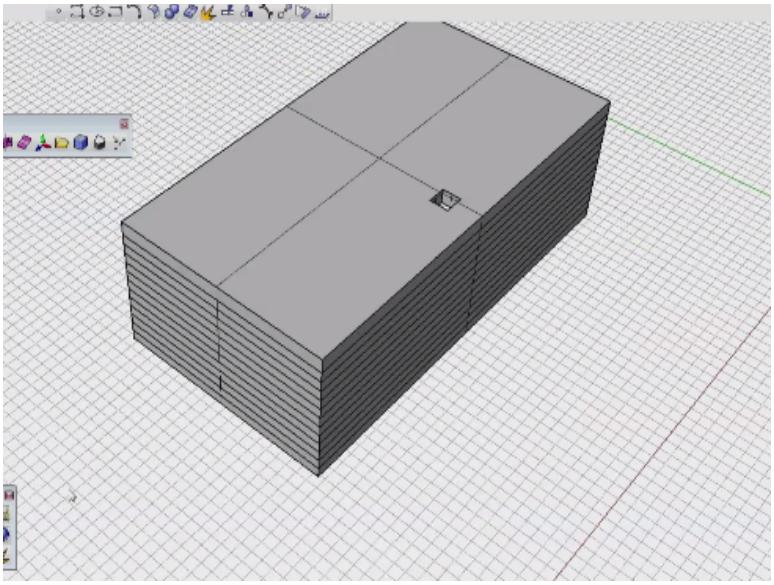

So here nice all I can say only thing I can say is nice and even if we were to make an object very rarely this object will be smooth and the way it is here because remember the what you are laying up is still a tubular structure so in reality if I now use a very thing what you call filleting I will probably able to make out a little about its intentionally making sure that I want to pick, my computer is slow.

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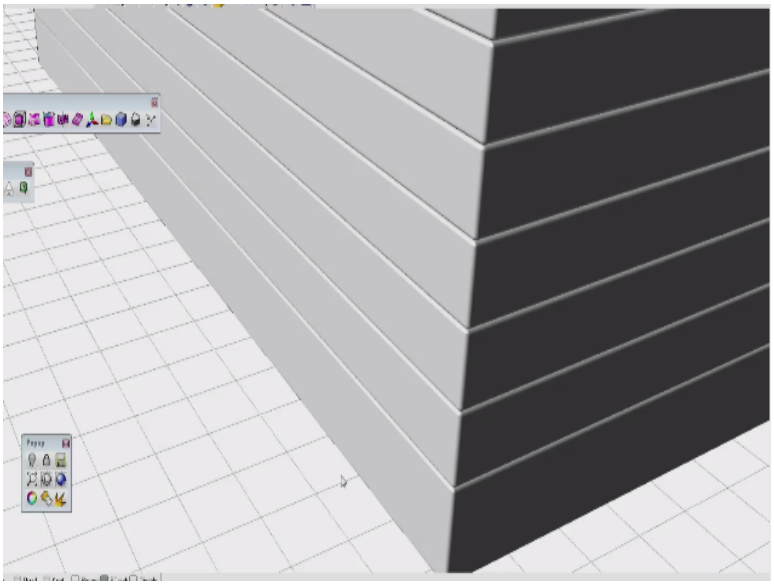

Finally, any object that is going to be created in 3D printing will have this little bit of granular structure this of course intentionally made what do you call with respect to each slice the radius is very small so you want to have them like sliced, but you will have large number of what you call grooves on top of it seeing this, this is going to my final object. Now 1 more thing I thought I should see this here is it possible for me to make it look like a real object.

Yes, very much it is very much possible for me to make it look like real object. One of them is can I put a what do you call a cover on this which typically represent the same circuit which I have seen here? If you have seen here I have a picture of a circuit here. Is there a way of my placing it on top of that, yes? If I see the; I need to open this probably in paint.