Physical Modelling for Electronics Enclosures Using Rapid Prototyping

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Lecture – 33
Flat Objects

Hello, let me continue from where I had left off in the earlier session. I had started with trying to show you how a little few fasteners are used and what you do with various things. Now, kindly look at this monitor and few of the pictures.

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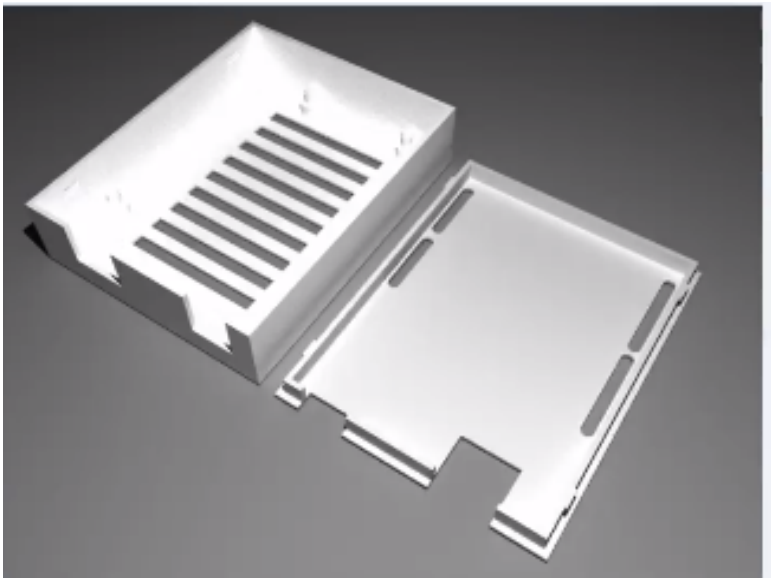

I managed to get from the what you call just by giving a simple search on Google this morning, just this morning means maybe few hours back.

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If you notice it anything you want to make is probably made already out there. So without adding my, what you call judgmental remarks just take a look at what all we have here. Obviously, we have 2 classes of items, 1 of them is typically these are all made for a well known what you call technical called the Arduino and uno. So you will notice it that at 1 extreme if you are one of those hackers seems to enjoy making things yourself obviously data is available.

You can make use of it as much as you can more and more pages more and more hits and then I will try to individual I have picked individual parts so that you can see what is going on here.

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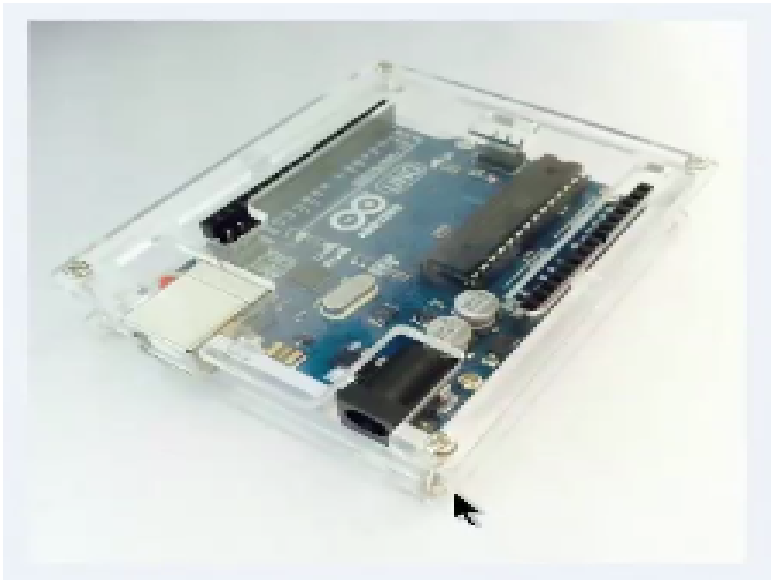

What sort of nonstop. See at 1 extreme we just need to make an enclosure and being in the learning phase and I being in the teaching profession we would like to see what is inside and so no better way to start then with the so called what you call universal thing right now you can see here. I fully acknowledge both the manufacturer of this case and also the manufacturer of this what you call module which is typically the Arduino uno and so many other things.

First thing what you will notice is the 2 very critical things you will notice here first thing you have noticed whole thing is held together by screws on the outside so you have a fastener here. Can you see it then you can also see inside that there are fasteners so we have a fastener here then we have a fastener here and this what you call a module is held together by internal fasteners.

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Now obviously whenever we are looking at this technical project we would like to see inside we use material like this which is a way of a transparent polycarbonate or acrylic sheet. You see here it is polycarbonate and so on while I do not justify any of the so they depending on the type of material you have and all that it is very easy to cut these things polyplast. Now you have you see this, this is a small clamp or something which can keep some other device inside like this.

It is just made as a demonstration piece maybe I can keep my mobile here, it is falling off, I will not risk my mobile. So see here it is just a support like this so we see the 1 good thing about this

what do you call this type of polycarbonate is it is extremely strong and resilient and such it is a tough material. So I will now take it out the thing. I will show you now a case that has been made instead with acrylic materials so the advantage of this being that it is flat and completely insulated.

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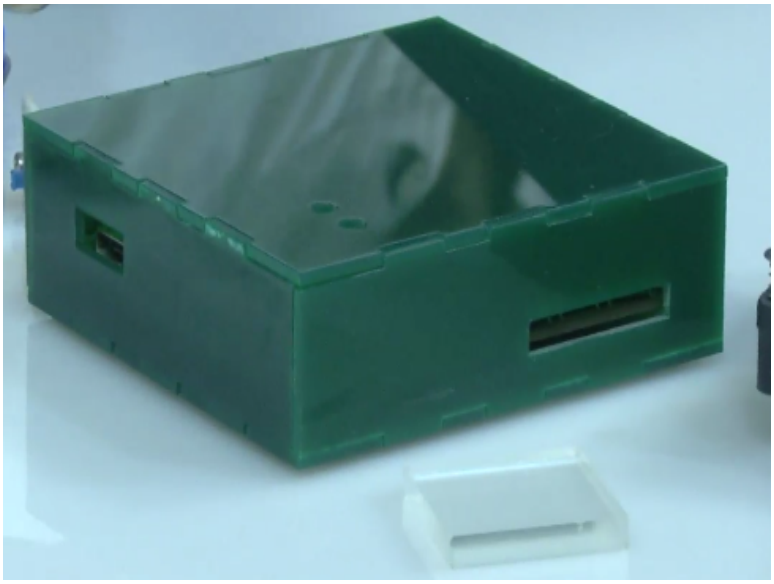

See here if I open it and then you will see the board inside can you see that is the famous old Arduino case, which we have here and the whole thing is held by this one.

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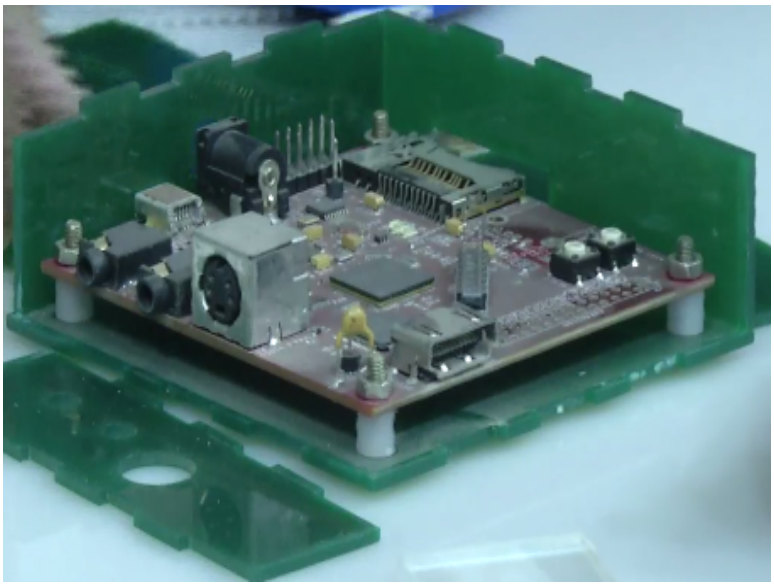

I think for intentionally they have assembled it and kept it like that. So these materials this covers come in the flat condition. So we have this flat condition. You see how it looks like and the

interesting thing what you will need to observe is that we have these fasteners here, can you see this here?

I have a fastener then I have a space, I have to have this. Now when I turn it over it looks a little ugly but it is okay with me not a big deal. More important is in case or in the unlikely case we have some optical devices for example if you have a ambient sensor or if you have a camera and all that we have an option of replacing this stop cover directly with a completely opaque material or we turn it over and add a black what do you call cover for that.

The moment you make it now all the functionality what I want it has been achieved, but what you need to first observe is that if you see here this whole thing is an enclosure like this. Can you see here? I have this same case, this is transparent. If you remember this also little like the Arduino uno that I am not sure which is that board and then we have this fasteners. This has been made using 3D printing.

So if you see the title of this what you call of this particular series was rapid prototyping with a little emphasize on 3D printing and in our case we have accessed to laser cutting also. So we notice here if you see this piece all the vertical pieces everything has been printed using traditional printing. So 2 or 3 features what you will notice is first of all everything is built in this direction up.

So if I go here everything is neatly built up like this in this direction it is here. So to the extent that there is no chance of any what you call something getting in the way except that you see here I have a small dimple here another small dimple here obviously 2 things are there and in the top cover again these dimples are also made. So a small bit of what do you call depending on the amount of overhang the particular system helps it is possible for you to build a little bit of this details and then later on if you see here you see this supports for the printed circuit board.

There is a small what you call a flat piece and then after this there is a projection so you can push the printed circuit board into this. So we have 1 here, 1 here and there are absolute clearances for the hardware. Now we can see interesting thing. When we come to this top cover because we

need to have a snap fit why I have chosen this particular object is that snap fit is also possible very, very first thing is you need to build a rim like thing here so that this rim goes and sit insides and afterwards we have 1, 2, 3, 4 small devices here.

So obviously you sort of hinge it pushes it inside hinge it and carefully push it in and after that no fasteners you understand know absolutely no fasteners and I do not know why the slots are given probably in the due course you will understand. Probably it is possible for us to you know manipulate a few things or may be connections you need to provide a connector from the top which will come inside like this from the outside.

After putting everything inside you can push the connector inside. Now you see how elegantly the whole thing has been made and you see here we have the dual function device here. One of them it makes a little bit stiffness and this part gives us stiffness, this part gives us stiffness. This small thing is this is possible that it may not get the stiffness we are looking for. So in those cases depending on the amount of material is available it is very much possible for us to make a small projection here.

If you make a same thing a little small projection here and another here or 1 little bigger 1 in 2 places approximately around a leave 02, 0.2 around 0.8 mm of this width if you provide you have a extremely functional, but a rigid object all done by 3D printing. While the previous object this one requires obviously laser cutting and a little bit of trimming here. Now do you see those slots which I was talking about? These are the 2 slots that I have been provided so that the connector can be pushed inside. Now I will go a little faster.

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Do I stop here or can we what you call improve our printing capabilities? This looks a little like the IP66 external enclosures that you know people have been what you call making use of. So you see here all the elements which I have put there I have been put inside except that we have a connector here. We have a power supply here and the whole thing neatly sits into a box. So it is very much possible for you to make something which is a little like this now how do you take the connections inside what you have to and all that, that is separate thing.

Right now I am only concentrating on this particular what you call way of using this. Now if you turn it on the other side you will notice that you have 1, 2, 3, 4 openings and most likely this obviously is the top cover from this and what you call pan head screws go inside and on the other side there are probably external threaded fasteners and if you see this, you this fastener has a unthreaded length. It has certain advantages for that.

For one of the first thing is after you push it inside from other way it sits very comfortably after this it goes in and when you unscrew things here it will come out easily. Now these are available in the market without any problem. I am not able to make out whether this is actually something which has been printed or they have purchased it most likely it is purchased it from the market plane off the shelf.

Critical thing what you need to do is what you need to observe is you see there is a small projection here all around can you see, small projection here and correspondingly we have a groove here. These detailing is very easy to create in our what you call this solid modeling. All you need to create is you create an object using probably a polyline command and you extrude it all around.

After doing it if you attach it here it becomes part of this, if you remove the material from the other side you get the negative mold in it and this red coloured thing could be a standard what you call elastomer gasketing material or even you can use your window the caulking what you call you have this RTV compound nicely introduce the RTV compound scrap it off. Then you place it over this may be you can add a little bit of Vaseline or something and then you have a practically water tight fit.

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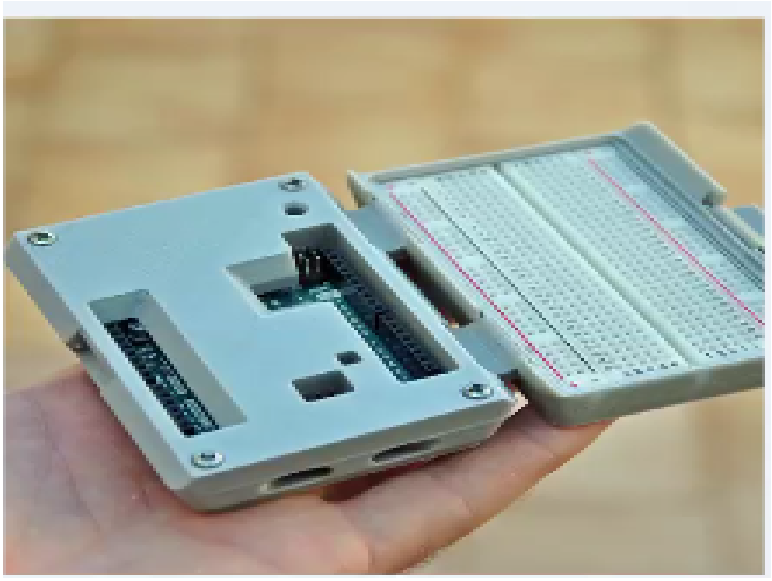

So I will go forward and see if I have, it is hiding somewhere inside, I will get back again, you will probably you will see it in the next one. Now see what they have done? I am very thrilled when I see such things. They have made a 3D printed box and inside you find all the active elements and it is a wish board and a beautiful wish board has been made such that you can carry it portable you can do all your thing that is take a connection from where the last row of them.

Probably have the power supplier or anything connected here and you can have a nicely running system and you see 1 big advantage of this is compared to the other laser cutting. There are nice tapers given here which is not possible in laser cutting. In laser cutting in 1 setting normally the openings will be straight.

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This is a fully printed box probably printed at home. Can you see here small extra projection has been given and if you see very carefully there is a groove all around? See can you see this groove and the same fastener which I showed you there earlier is now here so that the printed circuit board is held so 1 fastener here, 1 fastener here and we have a power supply and is a provision for connectors here and then you know all the thing is written seeing where the power should come where the other thing should come and all that which are there.

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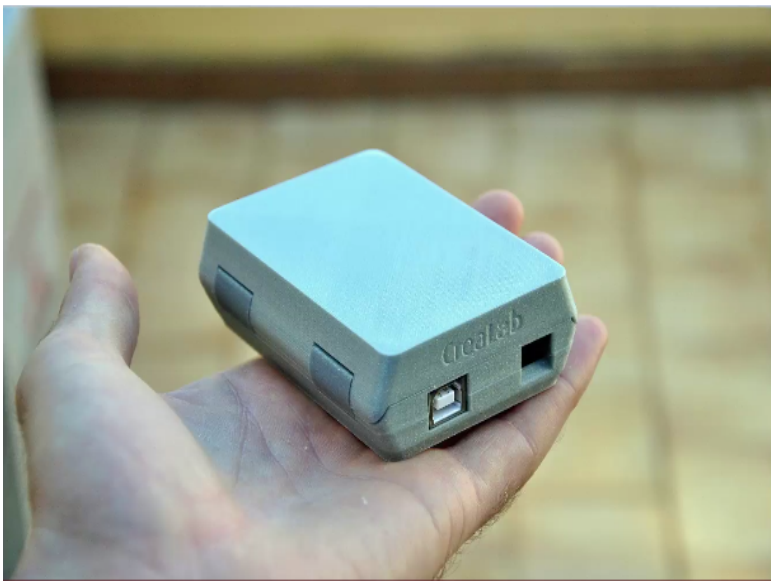

One you close it how cute it is. This is starting point close it, good. I have a hinge, I have everything once I closed it you see here I have the provision for the slightly modified version of the USB, not the standard USB which are using it I think there is a type A, B, and C, and so on like that and when we come to that I will show you the other side the fasteners that are used have been shown some reason.

So the starting point now seems to be it is very easy to create those things and even the hinge can be created by us and in principle it looks cute, neat, and I may acknowledging that it is taken from their website so I cannot read it. It shows I think Crealab.

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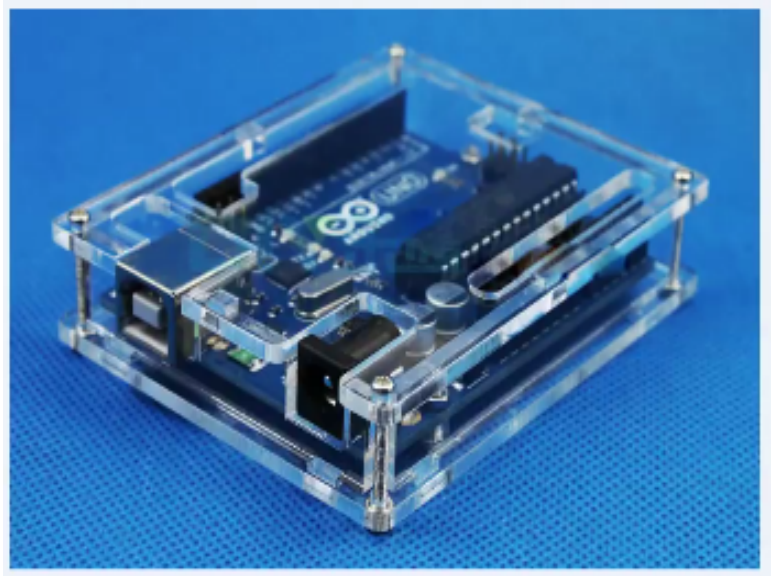

Next picture shows you once again a little similar to that except have you noticed something here they have to make some elaborate arrangements to keep this spacer. The very fact that I can see something here probably there is a vertical limb here. This vertical limb and this whole clamping down is able to keep it together. You can see there is a thickness here, there is a thickness here, there is a small space built into this.

Now you will notice that whenever we are trying to use these flat panels which are cut and all that the little bit of extra equivalent to about 1 thickness comes on all sides, there is no simple way of getting over it. If you try to get over it, it will be like that little green box which I have shown you. Well it is compact. It is not as elegant as possible. So I will show you via media how we can.

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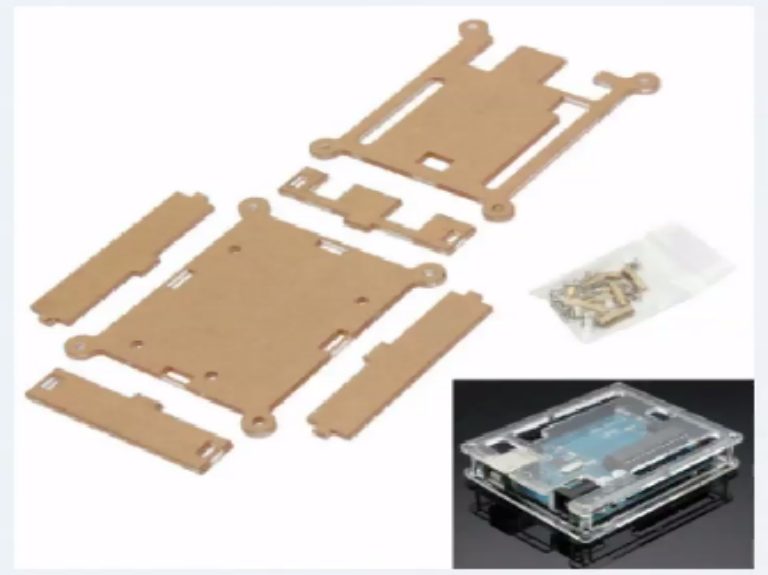

Now if you go and search on the internet absolutely lot of these open source files are available. This is nothing but the same thing which is covered with a backing shit and usually this can be even what you call printed or sorry not printed it can be cut using a laser with this brown paper cover which is stuck inside. It gives a neat cut and finally you can assemble this nice box which I have shown you earlier. You have seen this box.

Now you will notice that you see here this goes and sits there. This lug sits there, this lug sits there and everywhere a minimum of 1 thickness is required here then the whole thing sits

properly and now you see here in 1 side we have place for the connectors and another side back is this thing and it comes with beautiful things all these parts come there.

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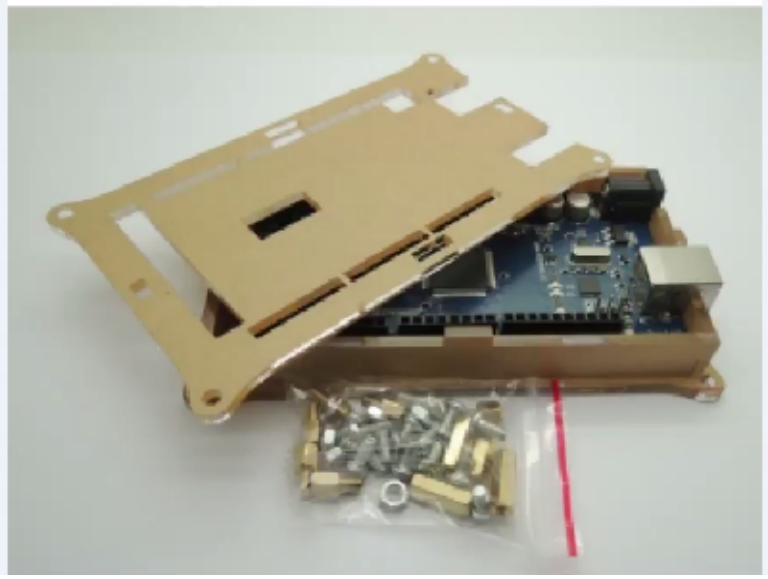

So in fact there are people who ship it to you directly. If you are let us say you are actually an electronic enthusiast and you would probably get to start off and you are not into designing these things it comes directly shift for you. You just need to insert it and then this is what I was telling you. See this beautiful hexagonal pieces these are all the various types of spaces which hold in place why I am saying this.

Now, if you are to make your own clone bolt then next subsequent things will talk to you if you are making a clone of that, not the Arduino standard thing, but if you use all these processor and all make your own compact thing, then you can probably make your own this thing.

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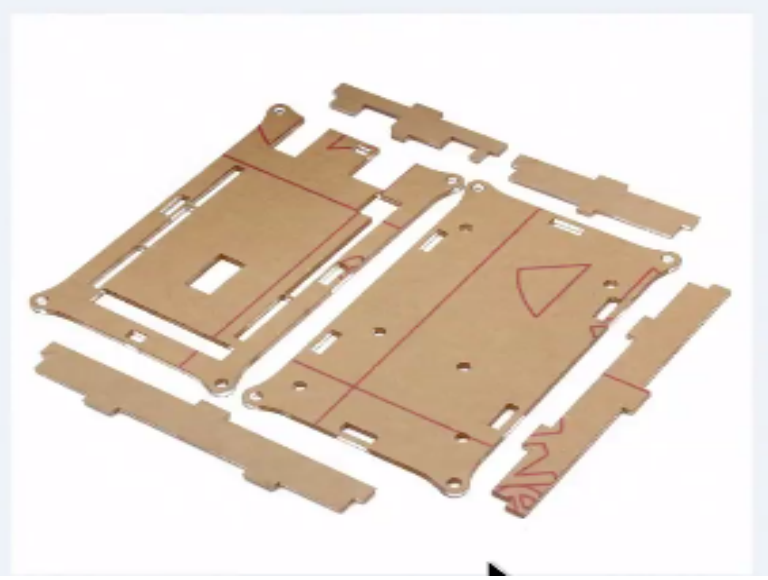

You need or need not depend on this. Seeing this everything is there and you see here. One small thing is the small supports are required here otherwise this likely to collapse inside and unlike earlier thing especially if we are doing an edging technique like printed circuit boards in which you do what is called a routing. You can in laser printing I mean in laser cutting you can make the part separate they will just stay in place you can remove it afterward same it is with a 3D printing.

These parts can be printed actually. The same file can be used, when the file comes sometimes it will already come in a; what you call simple drawing PDF or DXF file. Using the DXF file it is possible for you to recreate the objects go it? When these are supplied it comes in some format, sometimes it will be in the PDF, sometimes it will be in AutoCAD DWG or Autodesk DWG format.

So many other things are available including STL layers including what you call IGES or DXF. The advantage of IGES and DXF files most packages accept DXF. If you to get the DXF this outline and all comes. Now it is for you to create the actual object. This I think I showed you already how these you know fasteners and all come.

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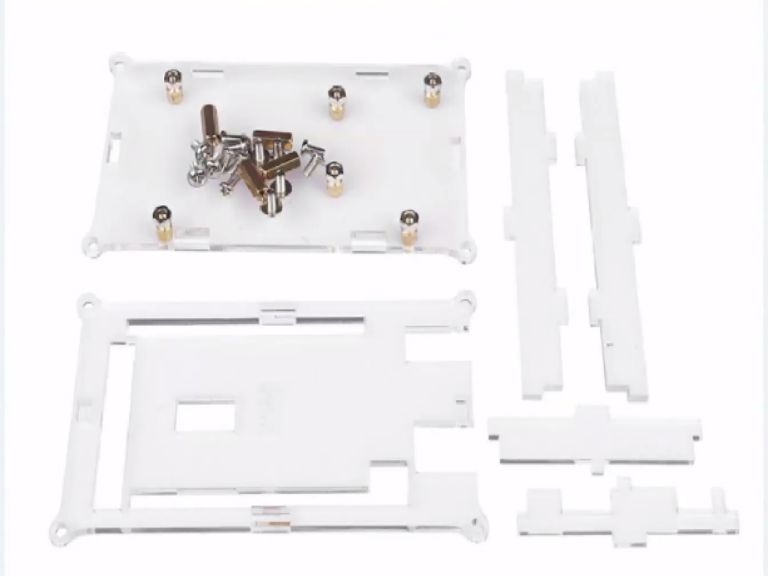

Now you see things are getting interesting again 1 more time. Can you see this is exactly what I was trying to show you by hand yesterday this is the small hexagonal spacer, which sits inside? It is assembled by push fitting. So you can see one of this spaces here and then you can see these spaces these are all this simple spaces, this one has a small hexagonal relief. You either print it or do it by this and then push it afterwards we have a very nice insert which is conveniently sitting inside.

If you see here, you can have a beautiful insert. It does a small neck like thing and for safety sake you can put super glue or if you are working in a chemical lab where you have accessed to chloroform most of these especially ABS and acrylic and all these things melt easily in chloroform. So if you are not what you call familiar of course you should not attempt it otherwise you can always put a drop of solvent which dissolve this in absence of that you can always put superglue and the moment you put it everything is there.

I have 5 things probably which hold everything together and you have seen 1 more very interesting things. This is not I am not clear in this now whether it is a transparent acrylic or one side sheet has removed and the back there is a baking sheet if you have a baking sheet most likely you can remove keep it until all your work is over then peel it.

And the bottom was shown you can always keep it in place that could be the bottom one and this could be the top one and you can peel it and it is possible for you that if you provide small things like an indicators, LEDs, and all that will be visible to you. If you want it to be more visible at the back, you make a small you peel of that thing at the back so you have something which actually looks like a working module.

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Now you see other things which we can also do and can you see this as a some other thing I am not sure what the object here is and that little bit of overhang that has been given here has been used conveniently as also fit for this so that if you are to keep it in the normal condition like this the bottom part does not get scratched so if you have the front and back parts assembled like this with a small you know projection here and all that and you see what has been done here with this on the top cover. This is the interesting part.

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A hinge has been created. So even if you are to build these things in using a 3D printing techniques you can build these independently and this corner can be used that is you take this space, assemble these 2 together the hinge part is ready then after that try to assemble this and then once you put everything in place you have a hingable top cover.

And then you see this is the small thing by that you can easily lift it both sides. It gives you a double advantage of locking things in place and this itself is actually a rigid structure. Why is this required because you may have to take a cable inside and then plug it in on to the printed circuit board? So it is stating the obvious.

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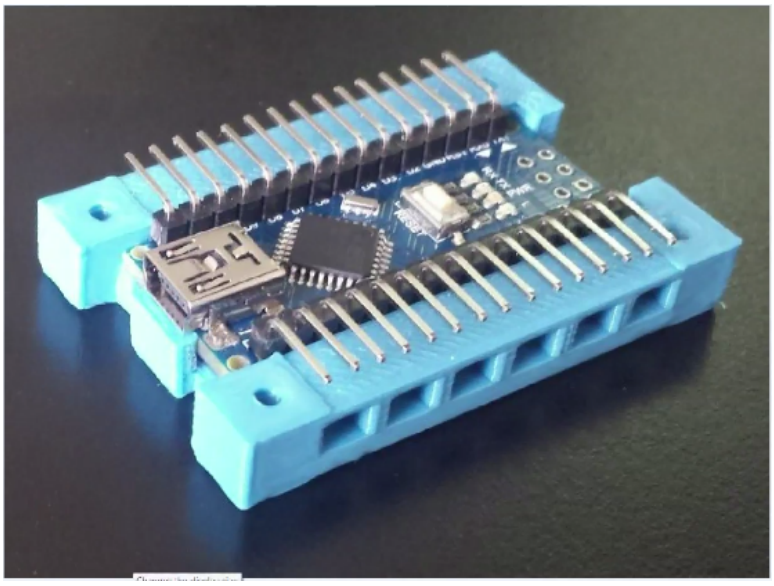

Now you see what somebody else has done here. He calls it a clone, it is not actually the standard thing, I do not know right now let me not talk about these things obviously these have a purpose whatever connections and are all available have been brought out. Only thing you will notice here which is very, very useful is there are lot of openings here and you have look at this, this finish if you are seeing it looks a little bit coarse.

This shows it is an honest representation of what actually they have achieved which I am extremely happy that somebody has posted it.

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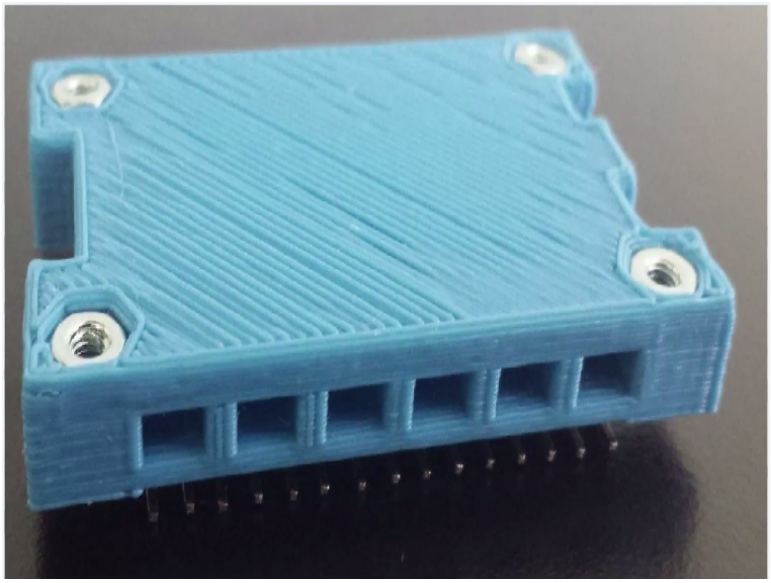

You see here this is how some of the less expensive home things are likely to look and the resolution also has been set, but interesting things what you need to observe is if you see on the other side or whatever it is you have seen that there is a hexagon and a threaded insert has been push fitted into that. In these cases, because they pulling force or anything is from this side you do not need to worry too much about it except any glue.

You can use in case you have 2 component what you call polyester resin you can have this glue which is used here functionally this is very, very good and they have tried to take the best advantage of little bit of detailing which he has learnt obviously he is a person who is very I am very extremely happy to see that somebody has made this. It looks not great, but for me it looks authentic.