Electronics Equipment Integration and Prototype Building

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Lecture – 03
Common Simulation of flat prismatic parts

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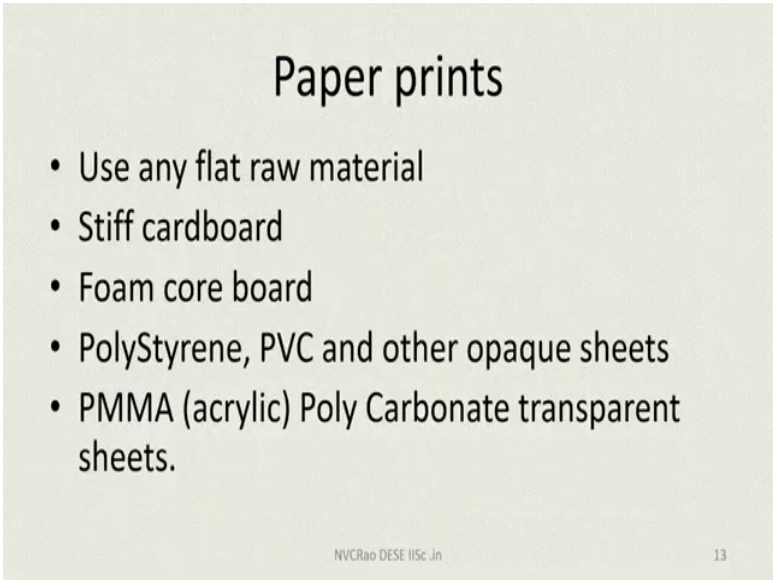

Hello. So, if you remember last time I have brought up to a certain point now kindly look at my what you call this thing. Saying its very convenient for us to use any flat material because most of the things are made and use the printout such template.

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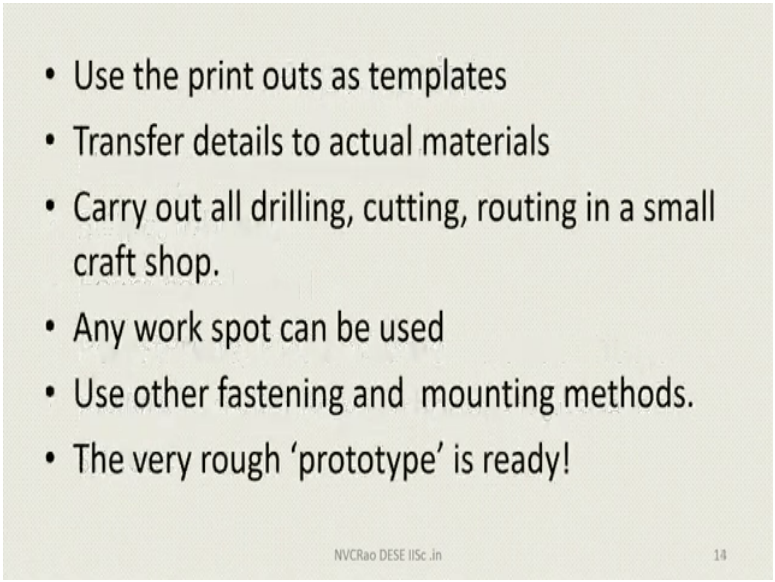

So, we have this template here. The intended material you can always stick it on the intended material, then you can carry out operations, then any work sport like it could be anything it here it comes to mounting and fastening methods. Traditionally in the case of molded parts we have snap in place.

Snap in place works well, but even there the first time simulating the snap fasteners are a little tough. So, much otherwise probably use a screw or something or even putting a tape is no problem. Holding two parts together just about anything can goes and your prototype is ready.

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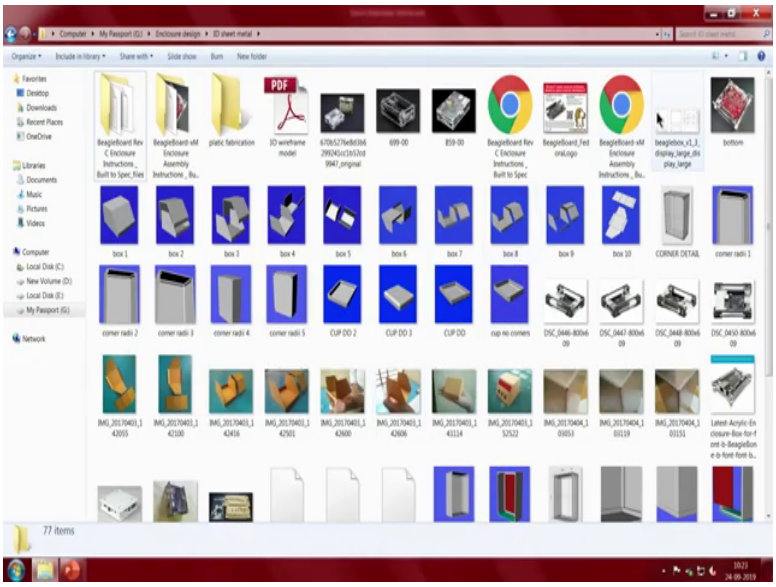

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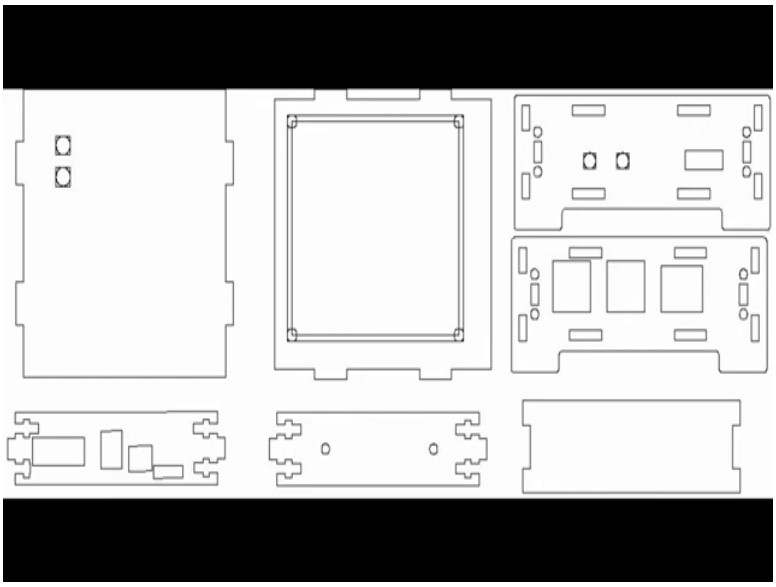

Now, let me start with a few samples. This of course, taken from the available resources and I acknowledge whoever has fast made it and got this going.

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This one is a layout shade prepared meant for probably laser trimming or laser cutting and assembling the whole thing together out of thing to make a beautiful system like this have you noticed this? These users exactly all the parts that are described there and in the corner, in the corner have you noticed this?.

There is a special key like thing which is assembled here. This key probably sits here you see here there are some places each will snap in place, then you have seen these two things these probably go and sit somewhere.

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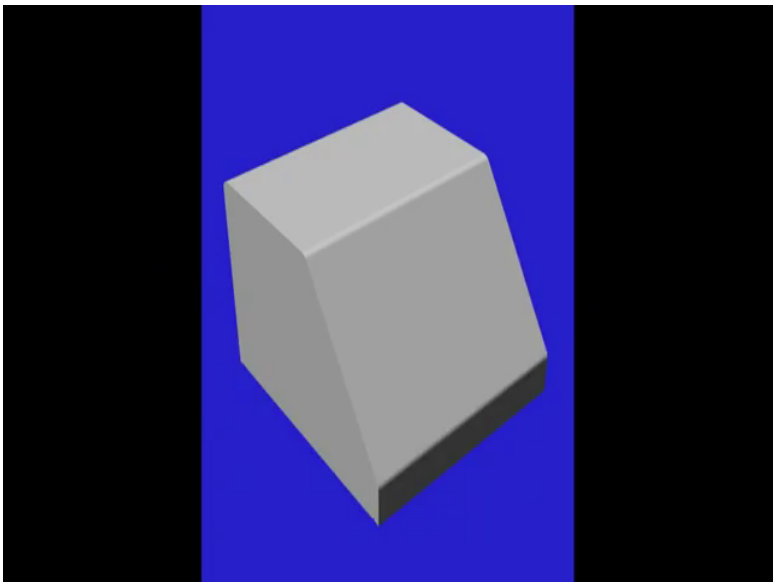

So, you see here even production parts are made with flat sheets and every time you need not go and depend upon a full-fledged printed.

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See the sequence?

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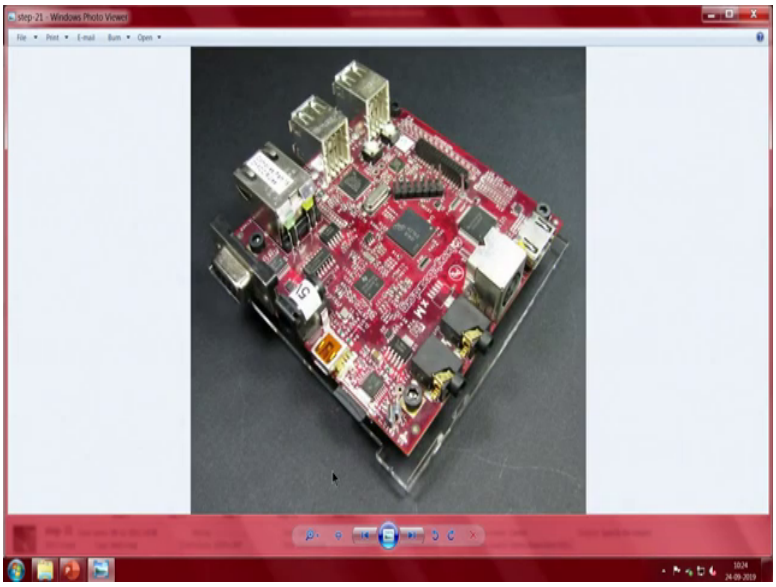

So, you have one part and then after that say these are all the probably once one I will call it one face and two opposing faces something goes and then I just pointed out to you about the key or some fastener which is put here and the other side is there is a bottom which is stuck on this things. Why I am showing you this is probably this whole thing could have been made in a cardboard at home.

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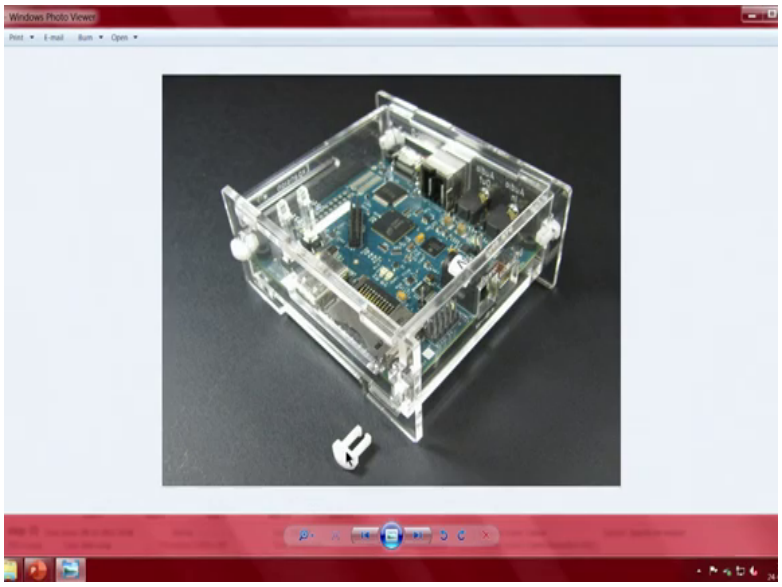

Because cutting a cardboard is easy you know you will see here the moment you assemble everything we already have a nice neat box and then here this key has been shown here now maybe you can relate that you push it inside, and everything sits here just opening part of them are opened, part of them are joined together see how cute the whole thing looks.

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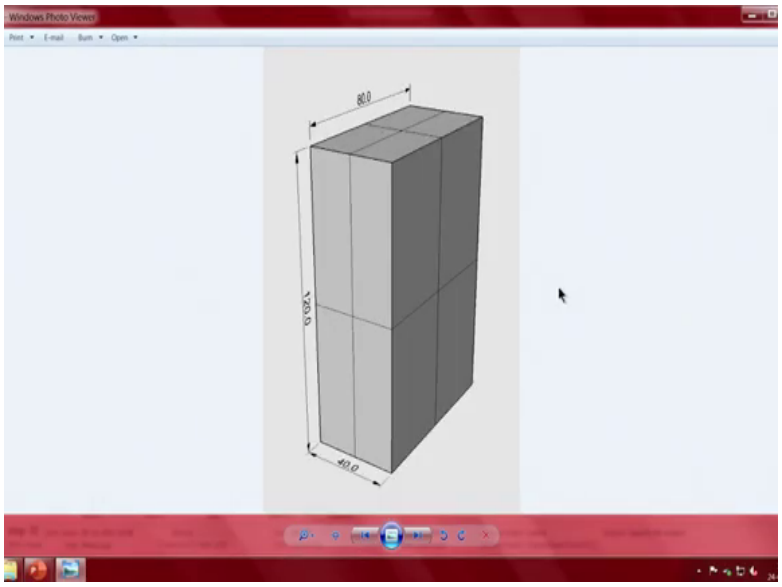

Now, let me take the case of something which invariably reality of fabrication is.

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Now, if you imagine one small I will take this, say here it could be any this is just a I mean made as a student exercise, the idea being cuboids structure and there are the basic six faces. Right now ignore of course, there is a seventh phase ignore that for you to understand typically the size how you will hold it in the hand and so on.

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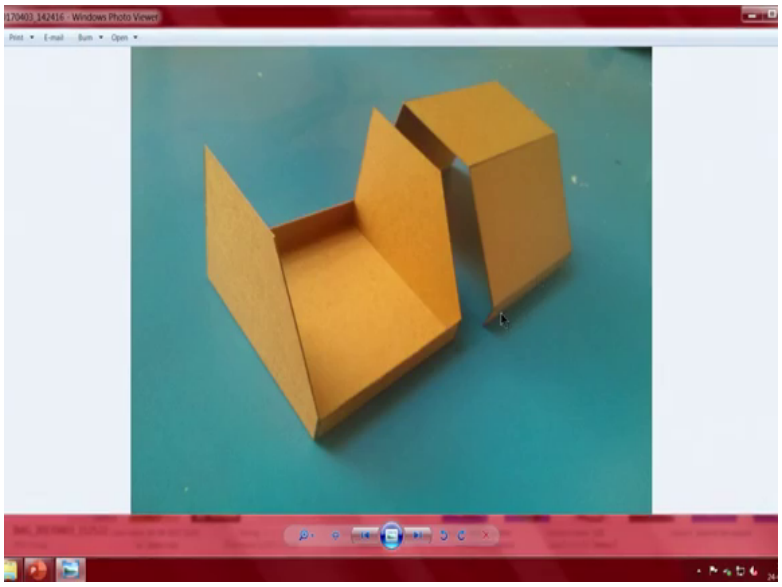

You have seen this, that is my hand and the whole thing when assembled by making things out of a simple cardboard. In this case its a hobby cardboard and two important details you will notice. I am sure you will notice this in the front there is a small tab and at the back one more tab is there. Function is tab is that it will hold the structure together and it can also be used as for the fastening technique.

Putting one on top of the other this being a flat object it is exactly how something made out of polystyrene or something made out of acrylic or something made out of PVC, something made out of polycarbonate can probably made as well it is yes. Now you see both of the parts are put together. Have you noticed some very interesting thing about it.

First of all just for simplicity sake thickness has been ignored, but in the case of sheet metal we will need to consider the thickness and you see a gentle inward curve is given that will

ensure that things fit. Now you see there is a development drawing I mean in not development drawing, developed sheet based on a development drawing that has been probably pasted on a A 4 size sheet and they have just trimmed it according to that.

The important thing one more time you will notice is that, see this paper, notching and a small detail which I thought I will help you. See here this line appears to run almost in the same line as this why do you need it? Fabrication will be easy. This may not have come at the first shot properly because if these are two a little different then which is the first cut that needs to be given in the workshop and all that know somebody has to work on that.

So, a little bit of thought has gone into that end transferring such a thing directly into the into fabrication in large numbers is very very easy. I just wanted to as part of this, you have seen this all that is needed nothing exotic nothing big nothing very different now.

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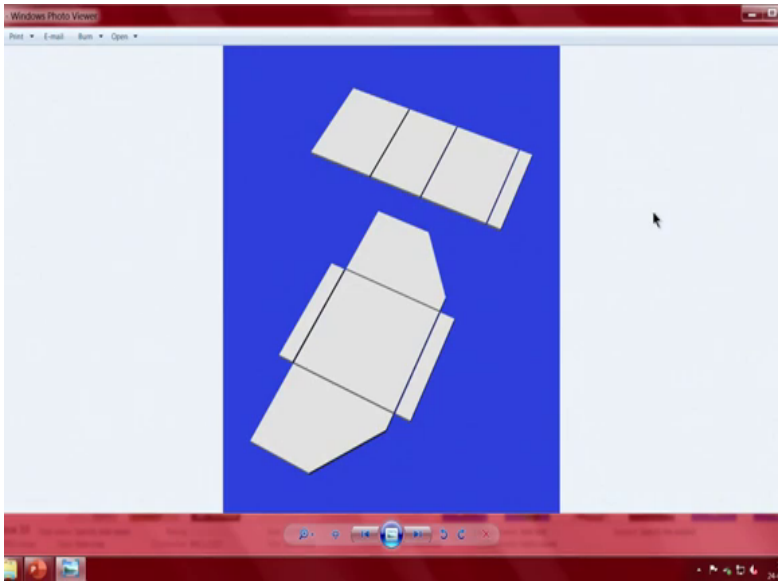

This is a slightly modified version of the other thing. If you are to use any other material other than the cardboard and which cannot be easily bent much easier way would be two probably make it into separate pieces.

So, here it is probably made out of an acrylic material or in our case generally what we do, top covers this portion of it will generally be made of acrylics so, that somebody can see inside and this whole thing will be made probably out of acrylic, but opaque. It looks a little like a project, but then you can place this on top of it.

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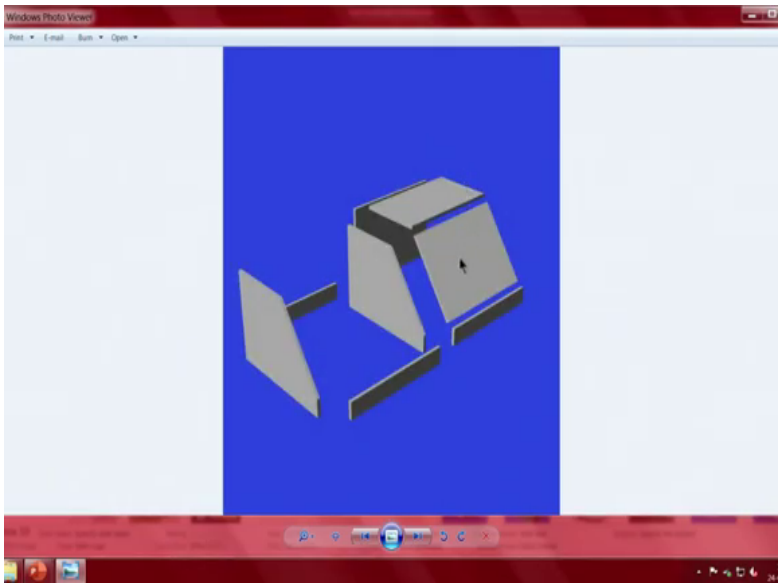

Now, if we come to the interesting thing no saying what about the front panel which are talking about. You see here all these pieces are small pieces. Now first time you will discover as part of your prototyping is that thicknesses are involved can you see here? There is a thickness and now we need to take a decision saying the height of this, does it go inside this

and this portion covers it fully or alternatively this is one portion and you have a test side to end caps.

Depending on your design and various things you would like to have, you need to make a decision to subtract the necessary thicknesses. Now, we come into this corner, you have seen this here? This has cut normal this also cut normal to the surface does it match? Of course, it does not do, but you see here, here the way this is shown there is a nice beautiful if I assume that there is a 45 degree angle, we have 90 plus 45 135 degree here it does not match easily.

So, at this point no a good craftsman or you just need to match things and put up with it as things are. Now we come with a very clever alternative why you need to match it at all? Why cannot you let the top portion over hang a little? Let it over hang similarly let this overhang a little, let this various at inside and moment you make this overhang by side lateral 2 millimeters, you can have the side panels also jack out by about 2 millimeters.

So, you have a bezel like structure three times bezel like structure and you can probably hide all the imperfections and part of the advantage is saying from the inside probably these two can be joined together using simple super glue or hot melt. Seen this of course, it looks miraculous, they have all been attached together and now what was a thickness less thing suddenly no there is a thickness.

You need to just put these things together and the other side of the view seen this. Looks all hunky dowry there is no issue problem at all except the little hunky dowry nails will probably needs to be cured.

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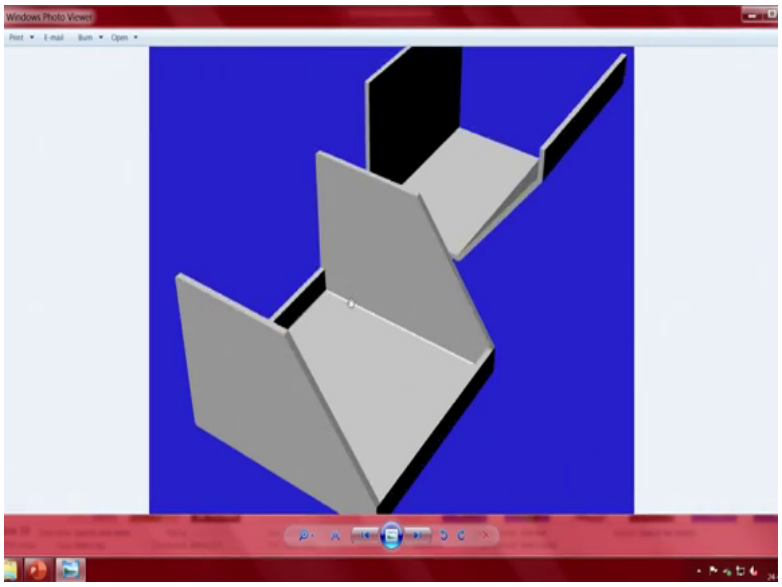

You see this corner, this corner seems to be a problem. In the original development; in the original development we have just assumed these things fit nicely and then in this corner you will see a very very interesting problem. This being a sheet metal exercise you will see that there is always a radius here can you see?

You have a radius now how do you let the radius match with each other? We have chosen to ignore it, but actually there will be a gap here and when it bends here, you need to give a corner relief for the whole thing. So, we come to actual manufacturing practice and this is what I was telling you here.

You see this internal and when you see this internal this appear sharp, but that has a radius something has to be done to address all those things. Eventually when you put everything together thing should look neat see here neat means neat.

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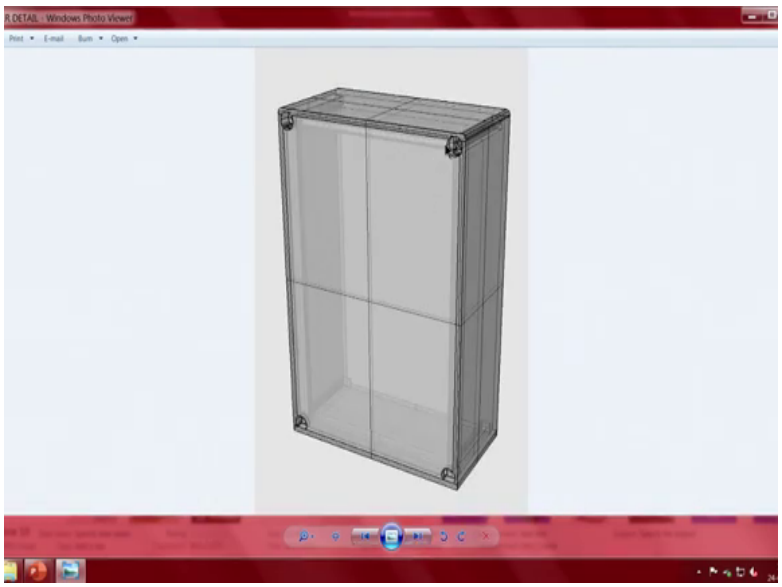

Now, let me get on with a little slightly different a universal, what you call enclosure. Often you find this in the catalogs; in the catalog you will find this saying these are IP that is Index of Protection 54, 55 class of standard electronic boxes.

You will discover some very peculiar situation by which your particular requirement does not fit into an available standard unit because you have not started with that; you have not started with the standard enclosure and arrange things so, that they can suit you and unlike the beagle

bone and unlike the raspberry pie and unless I mean unlike the various other things what I have shown you earlier on, this is not a standard for which this IP enclosure has been made.

IP enclosures have been made in a fairly you know interchangeable as sort of universal big system. So, if you are smart and you know some ideas that you are replacing another equivalent existing unit, you can use one of those standard modules and try to fit your electronics especially non PWD hardware. I have mentioned you right in the beginning itself, we have connectors we have control elements we have often displays we have so, many of these things which go into that.

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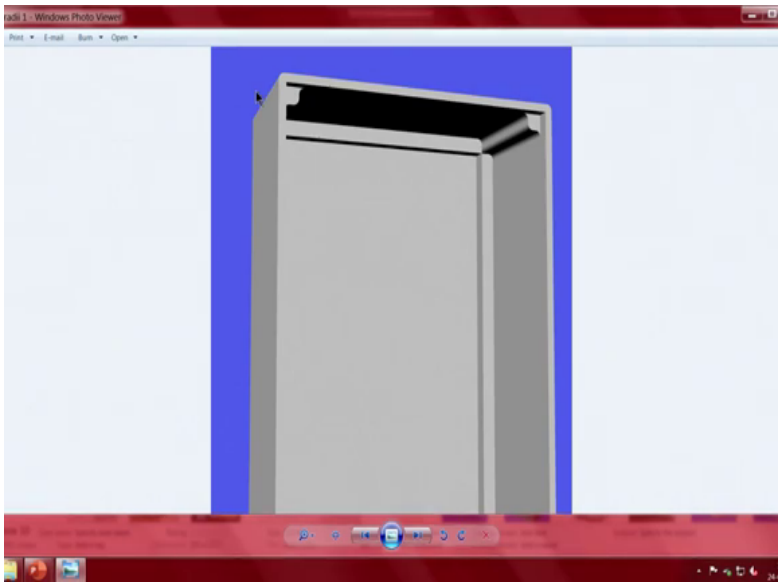

So, if you see inside one of these enclosures is actually not a molded enclosures, this has been just created in a solid modeling what you call exercise what has been done is, taken four sites of a layout with which we are familiar with. Saying imagine I take this mobile, now I want to

put something on the side probably a battery and probably I need to; I need to put something else and so on, I need to make it in to a neat enclosure which fits close extremely close and that enclosure may need a little embellishment say I will now use this as a test platform or something and then that particular test platform requires a larger battery.

So, I look for a low profile probably 10,000 milliampere, lithium polymer battery bank which goes behind it. Now, if I were to put the whole thing in an enclosure by putting everything, I have a test platform which can nicely have something which you can go on so, that you would every time you need not plug it.

Now why do we need it? I may use the this mobile as a data equation unit I can put it maybe in one corner of a room connected to a Wi-Fi camera or something and mind you I am not using any standard thing, I am building it and then I am building an app on this, I am building everything and this whole thing will go into that type of box which I have just now shown.

So, when we have a look at it this looks a little like this, actually it is nothing it is just for what you call our my satisfaction we have rounded it four side phases of appropriate height have been taken and this corner pieces have been attached to that and make things a little more, this has been filleted on the outside, but you see in thing now otherwise I may be a fillet here. I have been filleted everything has been joined together, it looks as good as a manufactured item.

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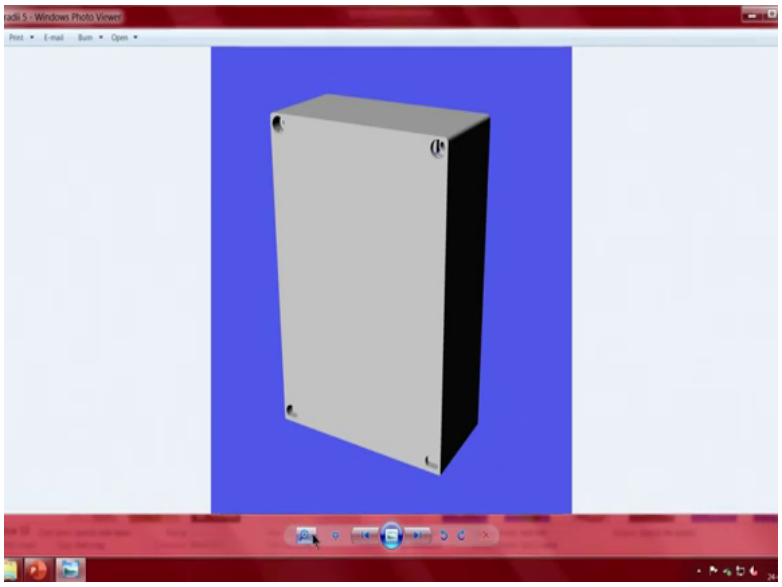

Now standard operations like drilling has been done and at the back I am sorry and on the top you have this now we have a box or you have an enclosure which is ready for me. As I want notice something here this is probably the back and then you notice something here, something which is very very interesting.

Counter bore and another side there was a something where it matters with a small adjustment. So, you can build in detail saying how we would like to deploy it somewhere, they need to have a clamp attach it somewhere all these details can easily be worked out.

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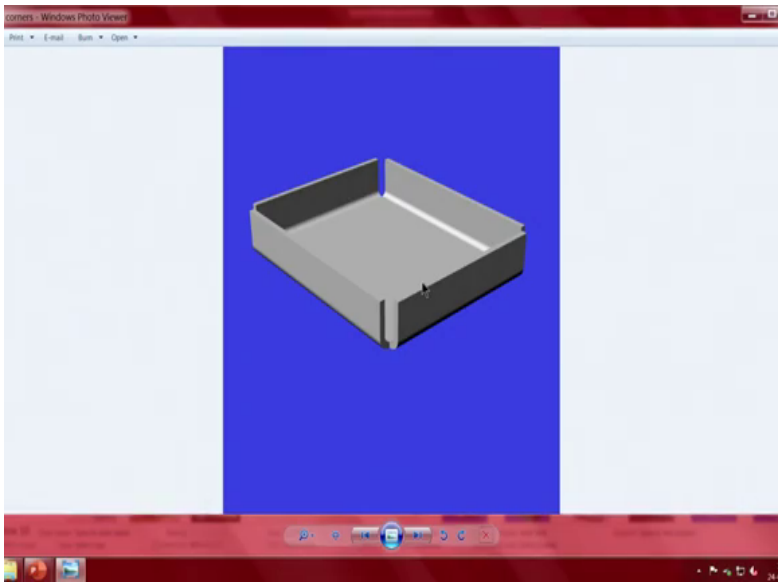

Now I will come back to a small thing I am sure with several of you have seen, this actually one of those small items which comes with our earphones. A things like this eventually will be made in plastic, but if you are to make it in sheet metal, you will end up with a very very unpleasant thickness all around it. Because of the small size this thickness looks very very daunting.

Now we come to the equivalent sheet metal of it imagine that particular thing needs to be strong like if you throw it should not break, it should not be made out of a brittle plastic which is likely to shatter in the corners. So, we end up with the sheet metal version if you look at it now, you have seen the sheet metal version this is what I was trying to tell you. This corner we end up with very peculiar detailing there is no way of it. Only other way is probably go in a little that side and then bend it up like this.

So, overall the dimensions can be maintained interesting is not it? This is where making a simple prototype helps even our people who work on the sheet metal often make that sample. Just take any available what you call material in the case of in my this thing as an engineer probably for your cardboard is better but in their case what they do is usually there will be some surplus or scrap material that make a print put.

Stick it on that surplus actual material which is likely to behave a little like the original material, then carry out all the operations and then do the correction in the main drawing. For example, one of the things I tell you, I take it that approximately there is a box of some given dimensions. I take it from one side to the other this may be around 30 millimeters, other side maybe 50 millimeters.

So, 30 by 50 while it looks very fine here, you need to compensate on taking this thing inside. We take a small thing inside here and once you take it and make a bend here this thing becomes a little likely to jet out. All these dimensions everything no can easily be worked out in a any cad program. Typically I mean most students which I come across are familiar with either solid edge or solid works and most of the day either by default or by Siemens or so, many other or any of the Autodesk products also have a sheet metal variant a sheet metal add on.

Those sheet metal add on take care of all these details , but the main problem is data regarding the compensation what is called a bending elements and behavior of the material saying what is the minimum internal radius and the type of fabrication machines we use. Everything is a variable which has to be taken from the physical shop.

This is the problem not problem actually the real issue with all the simulation work. There is a physical phenomena based on the physical phenomena you will simulate and then you find that one particular ratio probably needs to be altered a little and then hence you can improve the material and then either search for the material or make a compensation.

The same way in the case of these things, one needs to still make a sample piece of the final thing especially sheet metal and note down all the details. In absence of this for most standard materials data is available. It may be off by maybe 0.1 or 0.9 millimeters, but I am sorry 0.09 millimeters in general its very accurate and it does not really matter. For this things once again allow me to stress that the starting point is probably a good CAD drawing and a concept in the mind.

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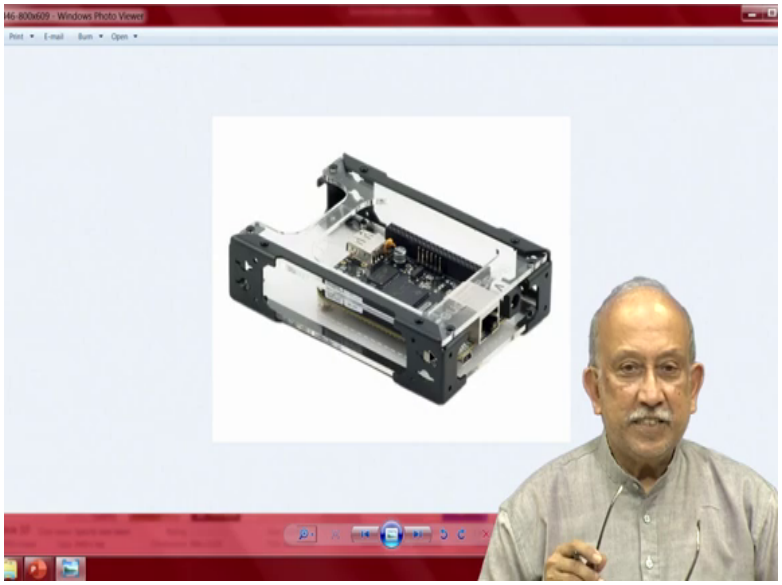

Now, let me say what the next one is going to show. I do not know which part of it is material what you call metallic, which part of it is this thing now you see here, we have beautiful.

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I think I have covered this I will now go back and pick on something slightly better. This is the laser trimmed at laser cut materials which are available on sale. Something have you noticed for example, your particular project may not need these two things may not have audio at all, you may not be interested in audio and you may have an SD card, but you may not have a what you call OTG on the go cable.

And in this case nicely USB I am sorry non USB 5 volt power supply shown there, but you may be using a USB and then the serial port is only at the time of programming probably you need it you need to have a tab which can cover it.

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So, now you will notice that once you get all these items, this is a kit now what about this? So, this is probably made by one of our students, you have seen this here, while this is actually made in a laser cut provision.

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I am sure the whole thing could have been easily made by you in any other material. This of course, is a professionally made item. So, you have various things which are sitting here. So, you can say this things can be built easily.

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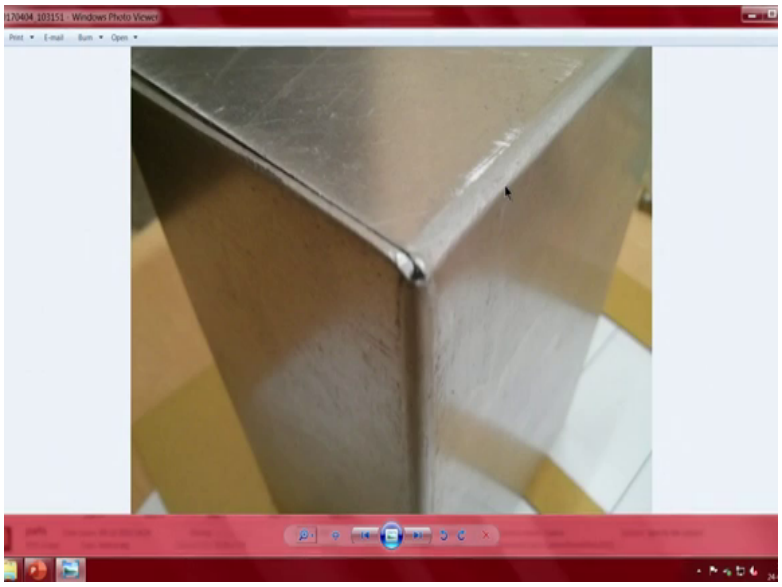

If you remember the earlier slide showed you about the corner that needs to be taken care of. First time when you go to the fabrication shop, you will notice that they these details while they are critical error probably killing the product as you know you wanted a product, which does not have everything it looks neat all the renderings are made look to you need to be to need to look good, but this is the reality of that.

So, how do you get over this? One of the reality is a radius. Another reality is gaps that do not close fortunately this is not your problem, [laughter] there is the problem at the fabrication level for the first time remember you are likely to make everything out of assembled sheets and then you show this, their process planning people will try to work out what best to make things. You see here, there is a very ugly sharp edge when somebody tried to you know work on the sharp edge it did not come out well it only made worse it looks crazy.

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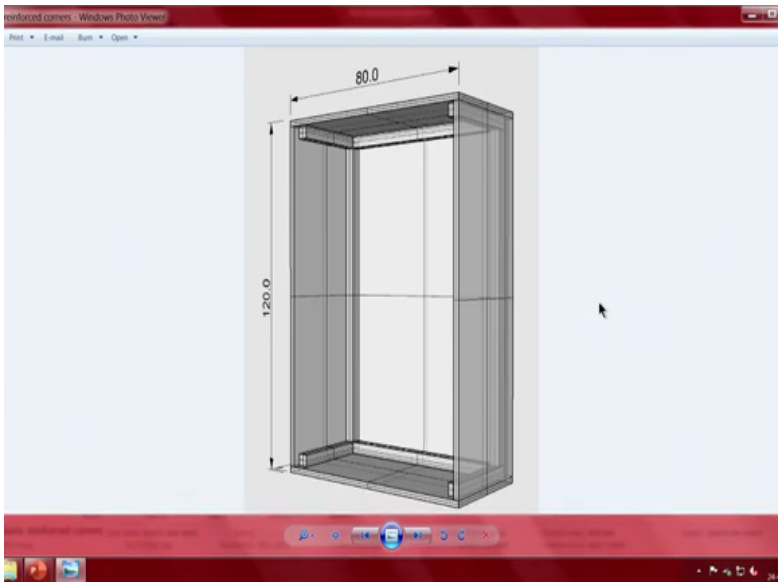

This is a drawing made by one of the very common 3D programs it has not by definition what we call full-fledged prototype making what we call an app or software, it just shows dimensions I want saying I need this. This is probably this is 80 by 120, this thing would have been maybe 25 or 30 millimeters.

Moment I have it now why this has been made is see this corner. So, this corner. So, what shows 80 is correct because it is visible, but this side plate need not be 120 it will be 120 minus two of the thicknesses. Looks (Refer Time: 28:28) we can (Refer Time: 28:31) or trivial, but this is the one that makes or breaks your product. Once you take the initiative and making this things properly, you will have nice neatly made corners.

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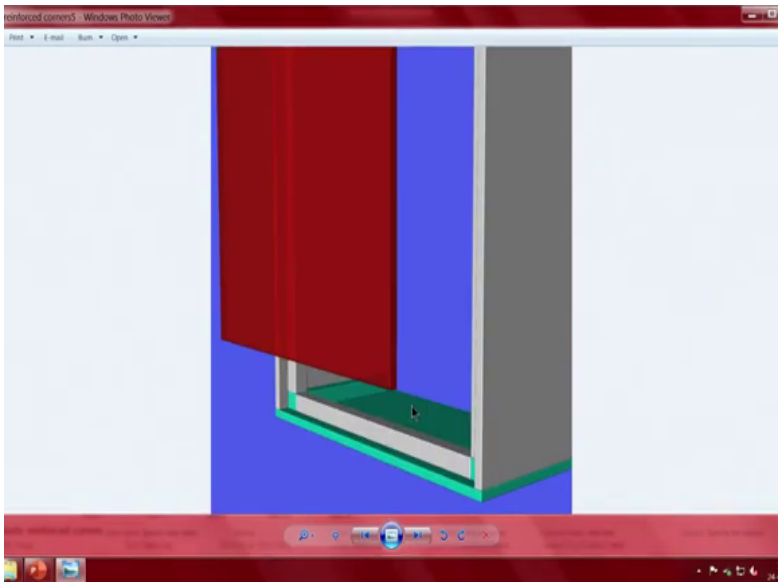

And you see here something else next one next, you can even in case you are using acrylic sheets and all that you can probably use grey plastic, I do not know why I have chosen green just to show that I know I can choose green and the top cover is a LED red filter. You can make the whole thing and probably one whatever it is and then add a small filter all the full thing can be made this and remaining thing can be masked. So, it looked like a real life product.

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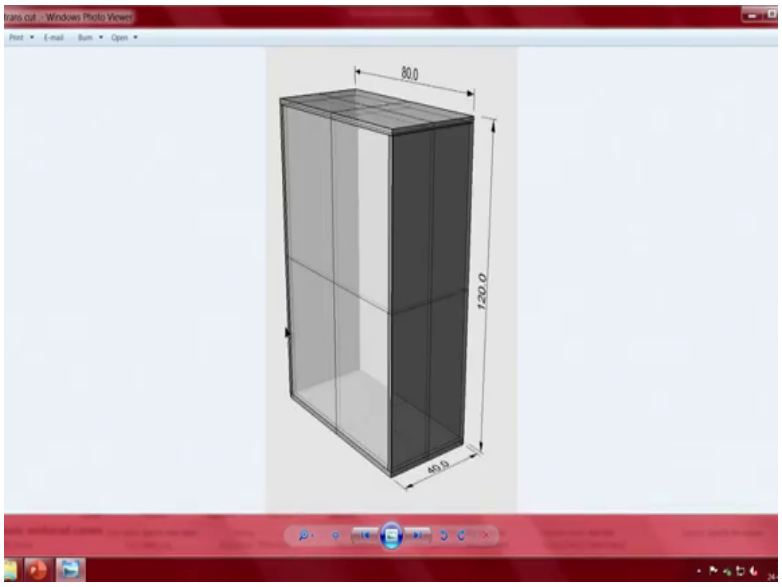

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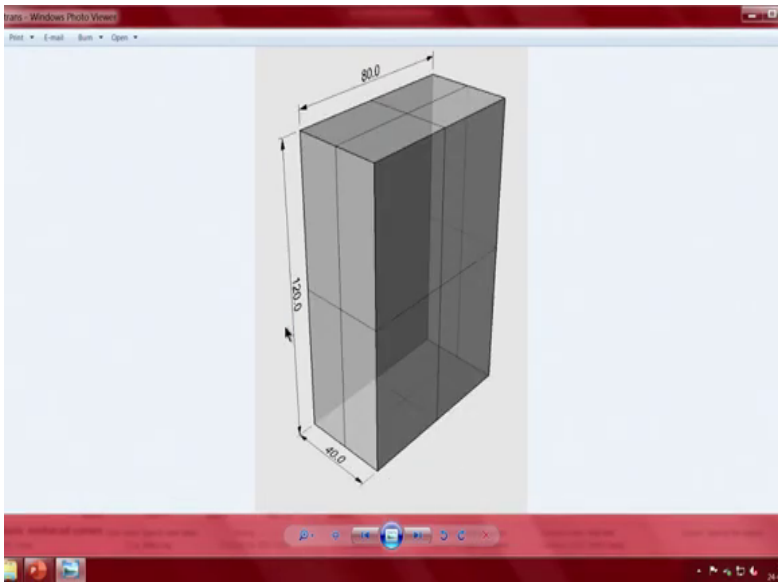

So, you have the advantage of happily using the smallest things available and trying to come up with things which look things which perform identical to the main material. And if you are lucky enough to have at least 3 mm or 2 2.5 and 3 m m sheets, you can directly work in plastic sheets alternately for the first two rounds you can work with cardboard as I said foam core so, many of these things that are available. So, I will stop here because it is you know its still quite a lot of things to had that have been covered in a particular thing.

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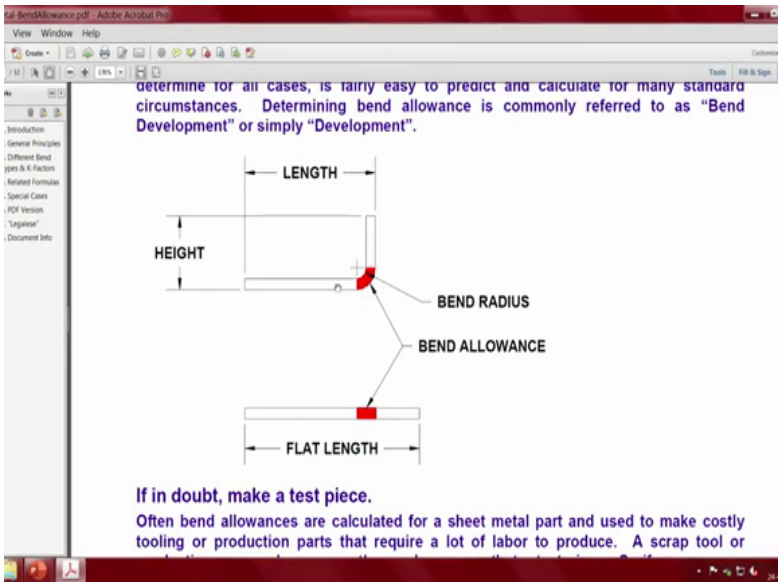

I will just show you though which is not directly related at the point here, this is exactly what its trying to show you. Now you will be asking sir you have started with what was; obviously, something to do with make things simply why are things required like that. Just I wanted to show you that in real life these things are involved. I will not go into detail for this at this stage because by definition I wanted to stick to something which you can make it home which we now come into another important aspect of things even thick cardboard anything more than 0.5 mm involves a radius and involves a bending.

Now, how do you; how do you take care of this bend and as I told you have a inside radius you shall have a inside radius ok. Then you have an outside radius and how do you make this things take a bend neatly. Yes try it take a piece of cardboard try to bend it a little here and there and see how well it goes.

So, thank you I will stop here meanwhile I want you to think about a universal remote which you use in your work place in the case you are a student and you have your own room, what are the various things your remote needs to have. It should not be very complicated like the ones that I have shown you that so many knobs so many things which are not that really relevant to us.

And if anything there only it is distracting and if you have a app yes you can work with an app and all that, but these days remember a lot of apps refer to having a Wi-Fi somewhere or they need they insist on Bluetooth connectivity a lot of devices may not have Bluetooth connectivity and what do you do with the old audio set or in the case you have a sound bar and in the case you have a television and the television has a set of box and here we get in to that very peculiar thing.

If you have a set of box and a TV probably you will be playing you will be only controlling the set of box and definitely not having further control on the main display. Because if you play with any of those elements which are on the remote, you will loose the picture because it will go off in to separate input mode, separate output mode and some of the remotes which come with us have tele textioned oracle which is I do not know if it really works or it something that ride and it never took off.

They are just; they are just the remotes still are made in probably large numbers and there are nothing we can do about it. So, think about it, I want you to think about a simple remote simple thing which you would like to probably have around which you can make in your time, which will control devices around your environment.

So, audio is one of them; external audio in case you are one of the people who try to wear a hearing aid am not a hearing aid, I am sorry ear phones can we control that and then something and all that. So, keep this in mind; next lecture I will try to present what? I will try to make rather I asked my colleagues to help and then what they are trying to make so.

Thank you I will stop here.