Electronics Equipment Integration and Prototype Building

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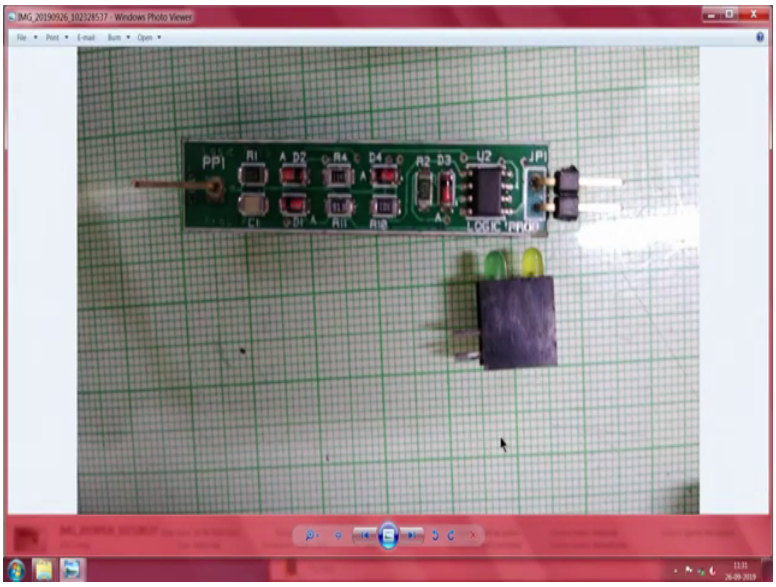
Lecture – 04
Common Flat Parts Enclosures

Hello let me continue where I stopped last time. As I pointed out to you earlier, this particular series is about how to make use of things which are available with you directly there in your hobby shop, at home, in your classroom or like me, if you have slightly higher researches there are no necessity for you to go about trying to book time somewhere else though, after this exercise you will be probably obliged to do that. (Refer Slide Time: 01:10)



Now, please have a look at the picture I have here, can you see? At the background, you just have a graph sheet. And various items which are available which need to be packaged can all be measured directly on the graph sheet. At the first level, I have directly used things which I have this, the one you see there this. It is some sort of I am not sure what it is. Probably, it is a

probe or a digital signal injector or continuity test or something, it has two vital components. One is the PCB it could have been purchased or you can bring it in there is a display device at the other side. And you can see here it has two LEDs and so on. For this, again let me repeat for the first instance, you probably do not need to have full fledged 3D modeling and all that all you just need is a graph sheet put on your workbench.

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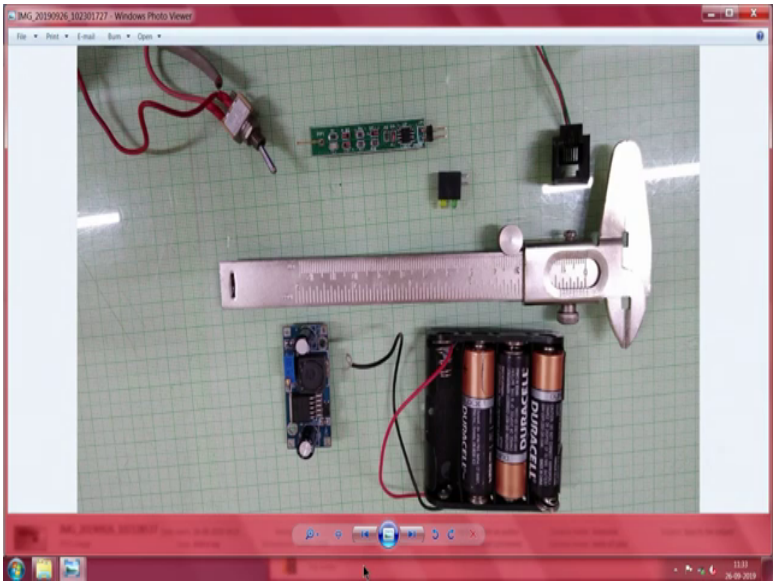

So, you have here, see here others things which I can collect around this is a very very low cost vernier, we call it a vernier some gauge and so on, this portion is the vernier and remaining is the gauge.

In fact, several options are there one of the external then internal then you also have a depth gauge and so on. The topic is not about the vernier thing, the topic is about finding out how

will all these items can go inside. What I surely already existing PCB, a pack of four double a cells.

So, once you have this you can probably even estimate, how much if I say to a what I call double a cell, what I call bugs can occupy, then you have again one more standard what I call some, that one is a off the shelf regulator, its a switching regulators.

You can buy it everywhere and then in India of course, for us they are available in several places, the cheapest is probably, Amazon and that is where I got it and this I am sure you are all familiar with it. It is a telephone or computer jack RJ 11, RJ 42 and so on.

And we have a small other hardware; first time you will notice that, it is the hardware that seems to limit all over packaging what I call issues, you understand know. All this hardware especially, this holder and this and then this and something to hold, this LEDs cannot be easily modeled in a physical modeling in a normal schematic capture software.

The best PCB or PWD layout software and schematic software, can probably make a neat placement of the components. But the moment you need this and the moment you need this, you end up with the third dimension. And that is where, their trouble starts.

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You remember this yesterday I tried to show you something which is taken from the, existing web. But then you will notice that if this particular board, I am not sure what it is whether it is a raspberry pi or arduino or its a beagleboard or whatever it is.

Most of the time, they will give you a general purpose case which will be a little bigger than what you need. I am not sure whether imagine you want to make something which involves driving a load, moment you have driving a load there will be power device. The moment you have a power device something will get hot. To dissipate power you have a heat dissipater of some sort, moment you have a heat dissipater you end up with this funny looking things. Though, the design is cool the circuit implementation will be things get hot.

So, you end up with things which are which need to be improved upon, some things have to be added on to that. So, all the time we are adding small add on things one of the things I showed you is the, what I call that thing is taken from a pentium cooler.

And of course, we have not kept the cooler and then, if you see the voltages and all know, here its 12 volts, but you also get fans which are 5 volts. And the moment this complexity increases, there is all over circuit starts building up. At one level, what starts with a simple PWB, we already have LED if your components.

And probably, on the other side we end up with power devices. At the bottom of it probably, we have a heat spreader. And directly on bottom of it, you have a, first air circulation. So, you see things are building up and what I wanted to tell you, the first time when you make it, all you need is a graph sheet. And then, you move on happily I hope please, if you have a look at it here, this was our final concept.

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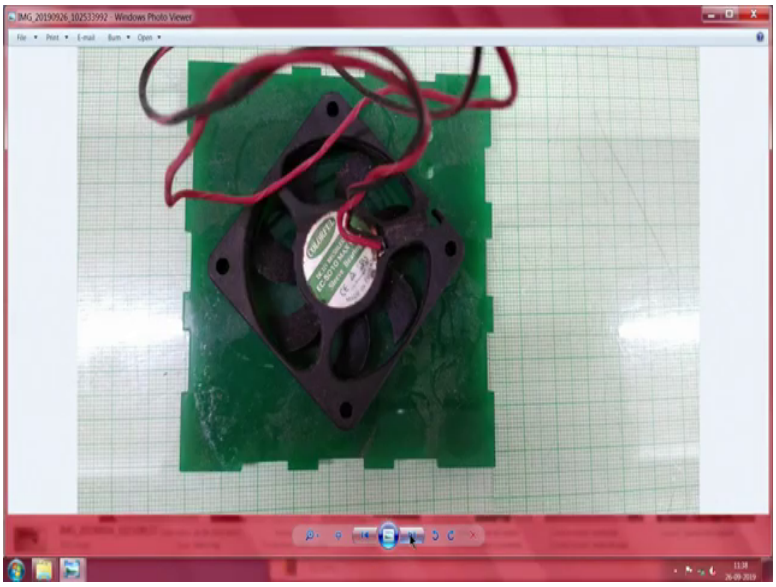

And you notice, one more thing is this, cooler has been made in a very strategic way. And the moment you make it, you probably need also openings and all and; but you see the background; background is still a simple ordinary millimeter graph sheet. The moment I put it to it, I need not add anything else.

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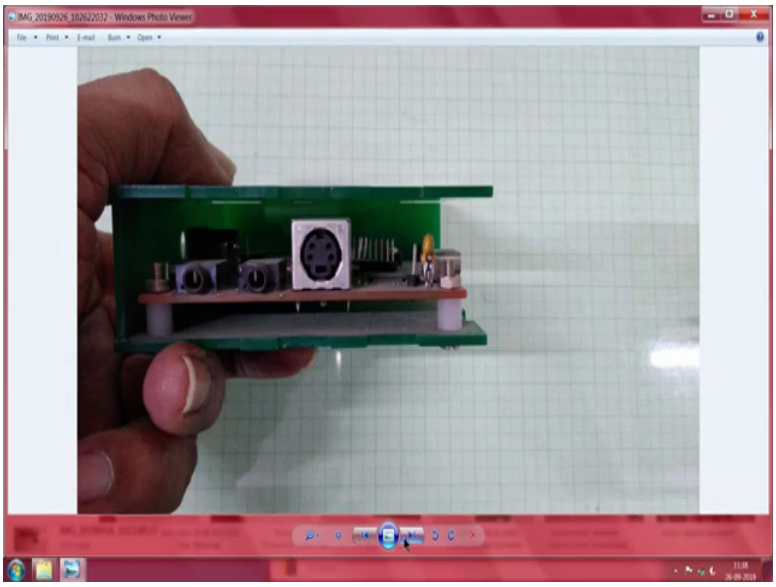

See here, me holding the PWB. Something which we may or may not have forgotten are this small stand offs, see in the corner. And every time you need not go about trying to make this complicated mechanism for holding it together.

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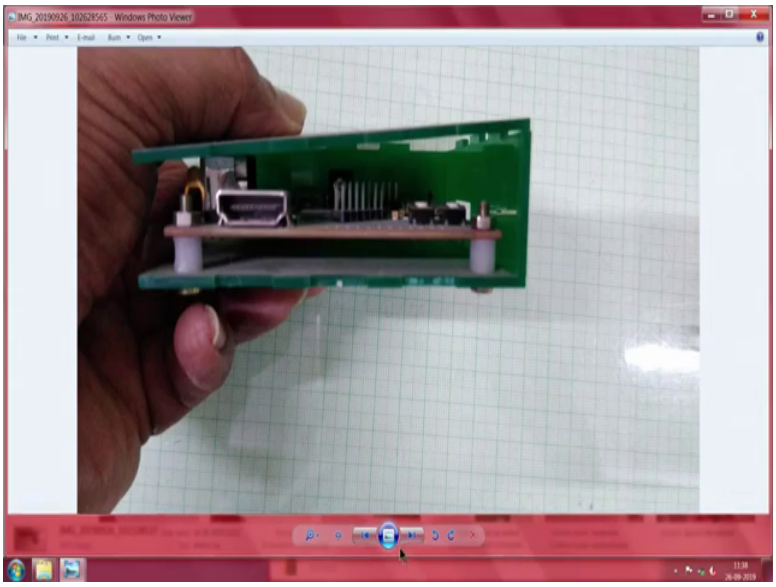

If you had to make it in your own, you can just take the graph sheet, spread all these things uniformly. And after you have spread or made light laid them flat, you can estimate what is going to be the height that is required. In this case, it is probably stopped by the some connector on one side.

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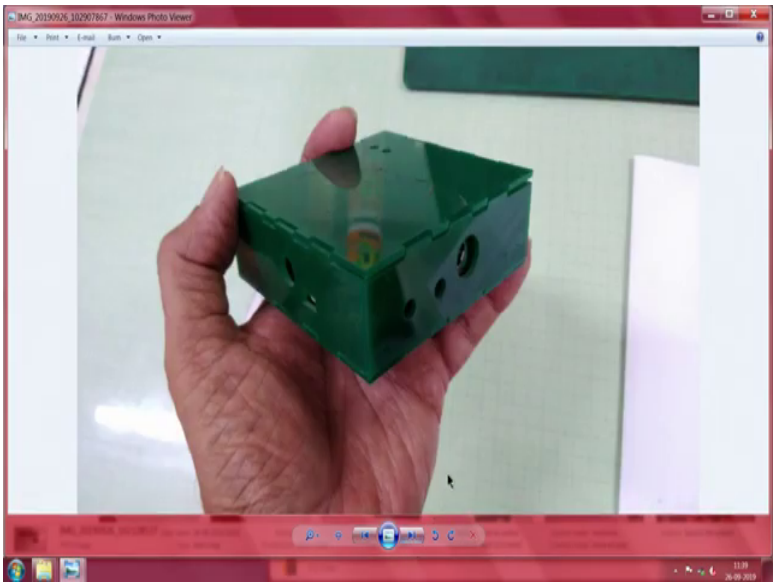

And finally, after you put everything together you see here, now comes the other thing here. Suddenly, if these openings are either the redundant or they are not present. So, instead of running to a laser operation, you probably from your normal layout, you see here these are small probably two trimmers which need access. A general purpose case will have other openings which you do not need. And it will not have opening, so its the way we want. So, this is where my suggestion, know.

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Just spread everything neatly on a; on a graph sheet start doing and because we need some way by touching this to this all this. We need all this details all around like this ok.

In the first round, it may much easier if we just hold everything together, probably even make things by hand. Not long ago means around 20 years back before, tabletop or desktop devices came all these things were made the way I told you about it. And even today, its practical for you to make these things the way it is.

Now, you see, these two openings are meant for power supply. And here is probably something aligned to this and then you have a USB things. All these details, we just look at it from all the other directions you can easily get it there, you can see this.

Oh Its, I mean; I am not sure its USB or it is a type c or it is a HDMI or whatever it is, you have this connector which shows all these things. And in case, you have the device already with you all you require is your mobile take a print, cut it to scale and you can play around by, rearranging all the components here. So, in the end, we have; we have this hand we have everything going for us.

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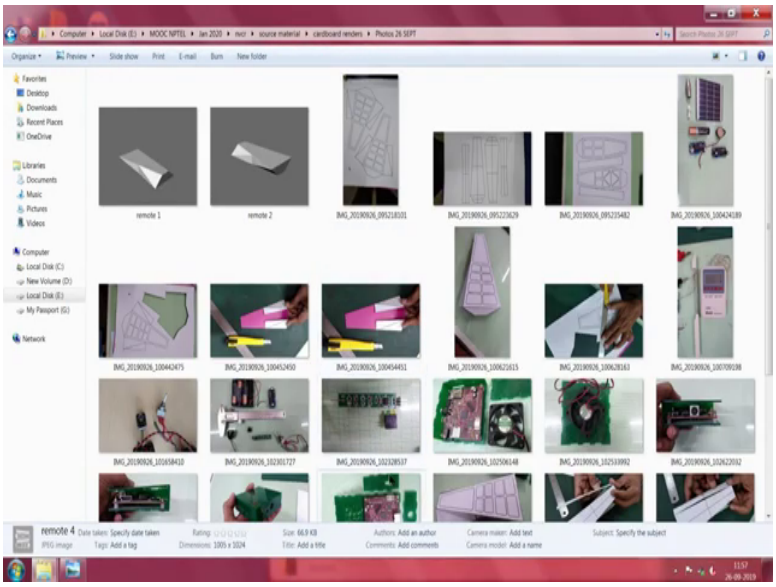

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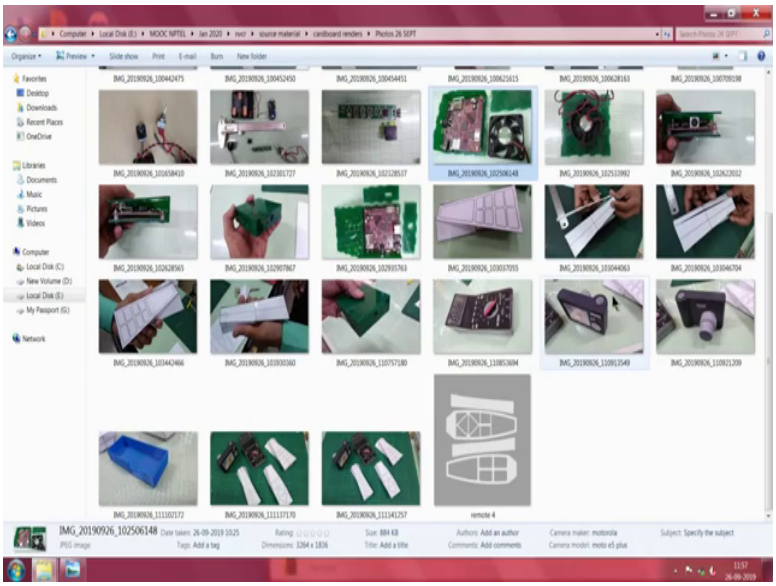

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Now, I will try to go on a little, let me what I call (Refer Time: 11:35) by what students like you have done, is done by hand and all thing is in cardboard. And front part of it is, this is printout probably done by home printer and it is a display, again done by a home printer and then we have made a exercise because, this exercise was specifically in cardboard modeling, keep it simple.

And we are not going to ask you about the, how good you are in the detailing, but they I mean in the concept, but how well you are able to make it. So, this student you know was good enough to even make us a switch and all this, are probably directly taken and printed from the available material on the internet including the display and all that. See here first time you will notice that it is very convenient for us and you see another child has made a camera, good I am thrilled.

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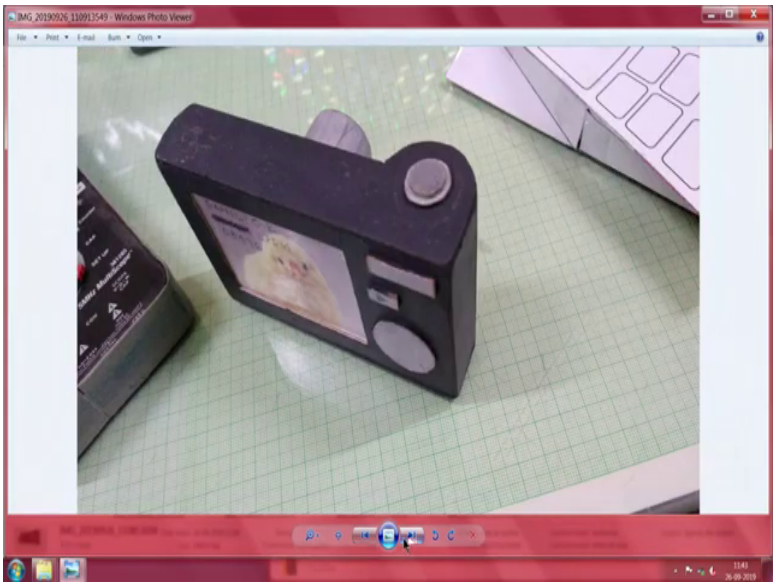

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And everything has been made with flat cardboards and probably in our shop.

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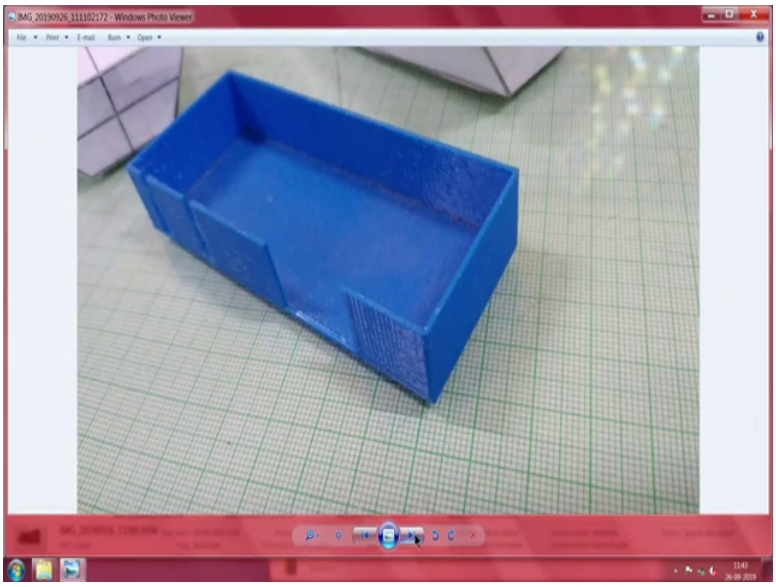

Now, we will get back to the original question saying sir, why are we getting into all this when, very easy for me when I have a home printer at home 3D printer, not just ordinary 3D printer 3D printer.

Suddenly, I will notice that what looked ok, is even not so great in the; in the case of a 3D print, noticed it. And even there, detailing for three d printing is very very critical. If you have any resources and you have anything else you know especially sloping, you get a funny stepped image which is very very tough and does not build as well as you want.

And very thin sections still require finishing of the unit when it is received after its received you still have to finish the unit a lot, meaning take it and you know keep on pressing it and all that; all that can be avoided. At first time if you tried to make a flat this thing.

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So, all of them have been placed here you say here, I spent a little time with my colleague, so help me and luckily we have a professional cutting board. This one is made of some, I am not very sure what the material is a sponge like material where all of this is printed and we can arrange things directly on this you do not need it and all you probably require is a graph sheet on which on top of which you have a glass plate.

So, at the bottom most you have some flat surface like your table on top of it you have a graph sheet and top of it you have a glass plate and you can arrange things directly on that. Why the glass? Because they then the graph sheet is not stained. And the best sheet can contain the printable area of your printer that you have at home. So, the moment you have it now its easier for us to go ahead and make very very interesting things.

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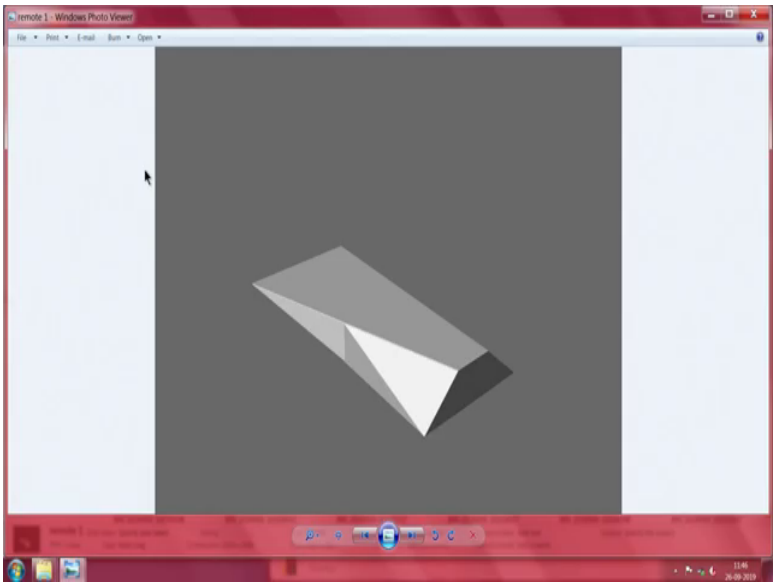

I wanted to make as part of the student exercise, can I make a remote which slightly different from what is usually sold with, sold to us by various companies. One of the first thing is; it does have a peculiar angular this thing saying that is part of the design.

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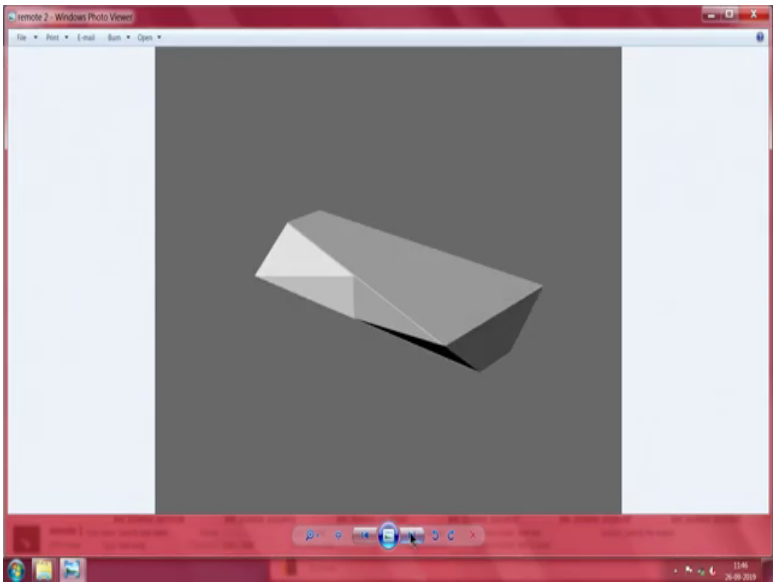

And second thing is you have seen here, it is intentionally made to look upside down, you really do not need a large area for a display and crowded keys at the bottom. So instead, I decided the display need to be small and the keys area can be big and it should nestle comfortable in the hand. So, I have come out with the concept like this and I requested my colleagues to help me out and luckily you know they helped me out.

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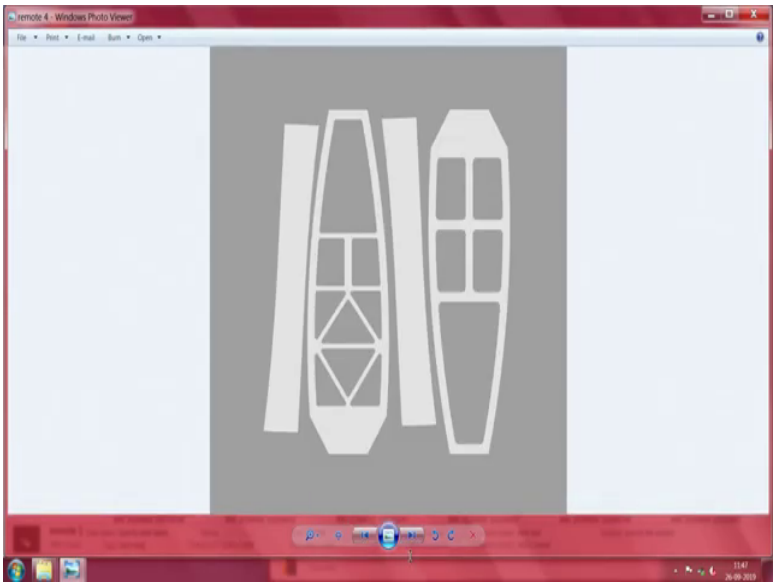

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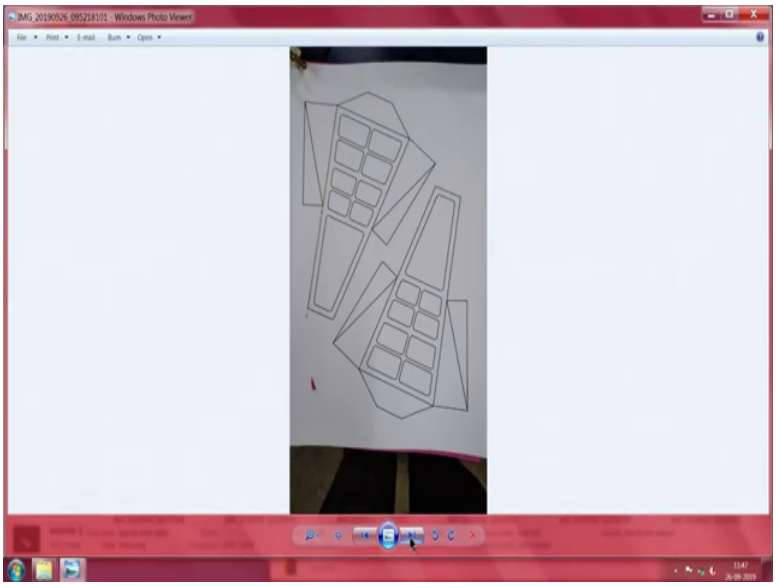

You see here, all thing is printed on an a four sheet, other variants more variants.

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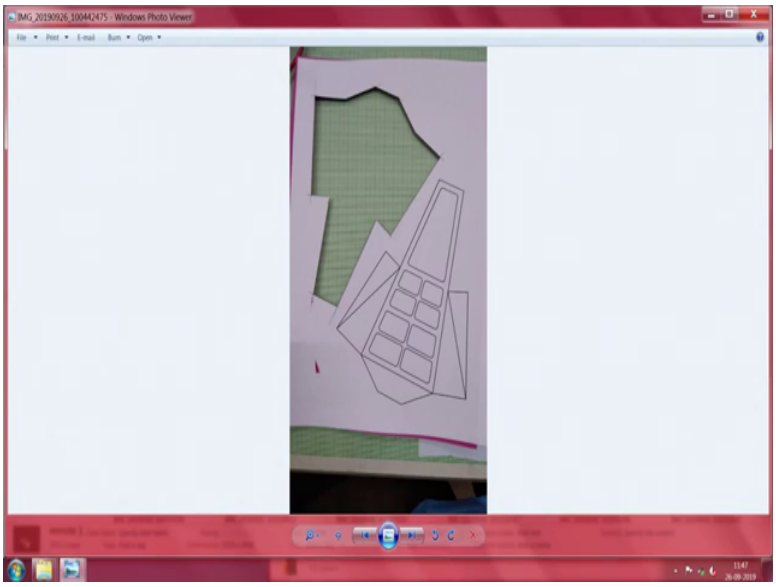

It has been stuck on a thicker what you call a board and as I told you on by principle, we wanted to have it, locally made and what I call to be printed.

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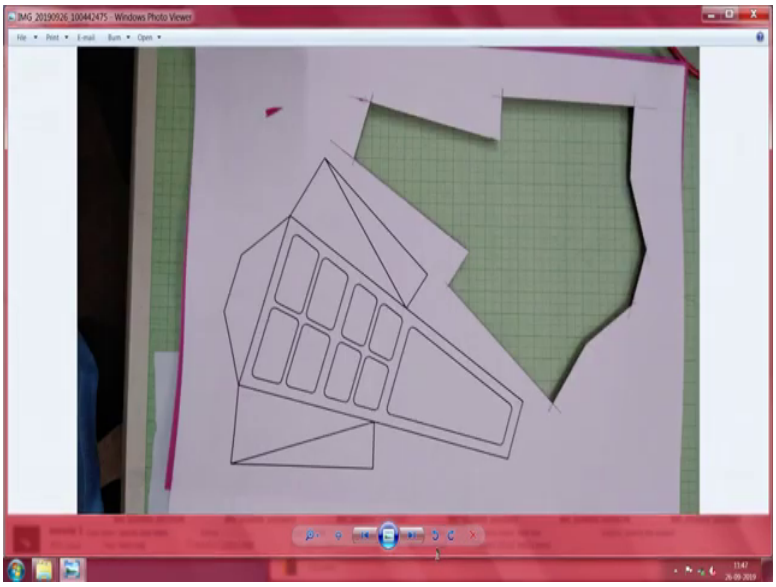

So, they have taken a, what you call slightly thicker cardboard which you can all the school kids and all use. Stick, they developed item onto that, then cut it and release it using a straightedge

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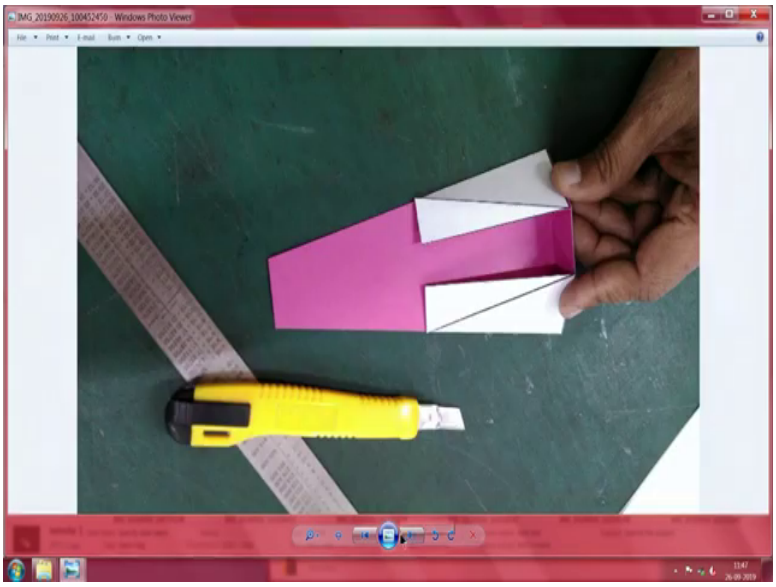

And did I show you that cutting board? That cutting board is made with a special plastic. So, when you turn it over on the other side, this is a type of a self healing memory device. You can cut and if you just leave it alone things joined together and you can reuse it again and again.

At this particular devices being carefully used by a we have a professional model maker he has been using it since 20 years. But he knows how to use it as such know there is no problem. Now, you see here that printed sheet carefully, yes try to fold it little closer process of cutting trying to attach it together.

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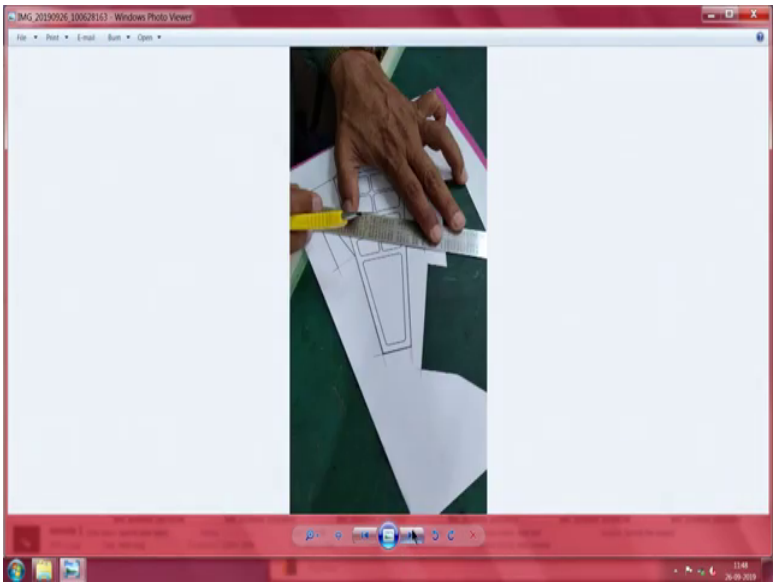

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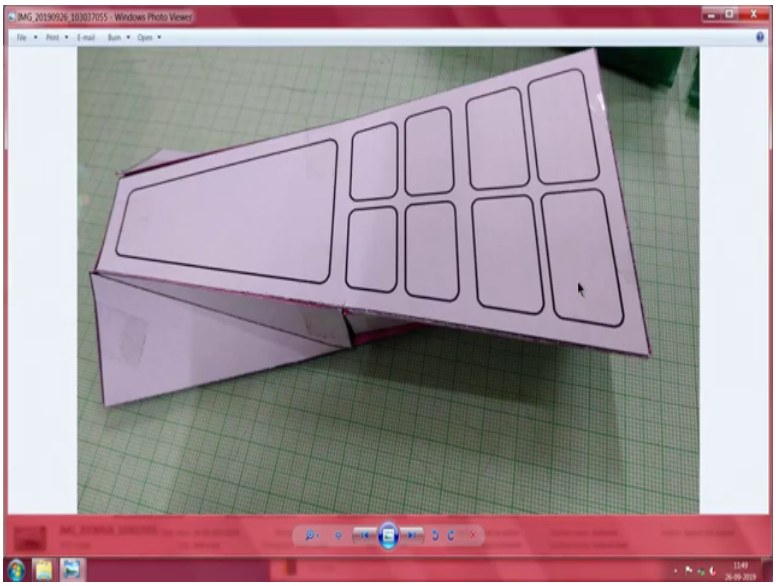

While the other one had only flat features, this one for the first time also has other features in it. The advantage I think as, I was telling you earlier is that it nestles comfortable in the hand. and I have all the place for the keys.

And in the display, this display is going to a very simple display, when for example, on this side when you are trying to use. It is probably going to have a volume control buttons which will go up and down and I have a channel buttons, which just shows which is the channel your favorites going up and down comfortable format use and then if you see this portion of it know it nestles well in the hand.

I think I have one of the pictures in which, yeah. See, how it is being held, this is towards the object in this case, it could be a TV or it could be a what you call, audio device or it could be any of the things like a ac or it could be our lighting or it could be our audio devices and all that.

And you will notice here, this is the palm and it fits neatly in the palm here. And this inclined surface and this here, there are place for me to place additional case on this side which I expect the moment I manipulate all these things.

The amount of keys that I require maybe reduced at all and this a perfectly symmetrical device this width here, width from here to here fits exactly the width from width here. So, if I flip it, other side is equally another variant of it.

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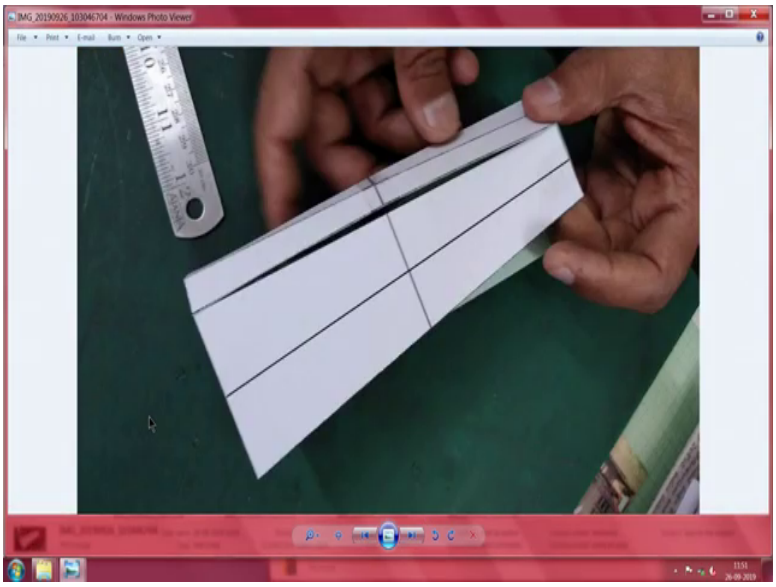

The way all these, the things which I have shown you earlier it is being cut, such of the features that are straight this particular device has been made such that everything given there is straight, seen this. All the things including the outlines everything are straight. So, that you can use a straight edge and for the initial thing, this is very very comfortable. But later on,

when we improved the model, see this is the straight you understand these parts of it straight, except there is a gentle curve here.

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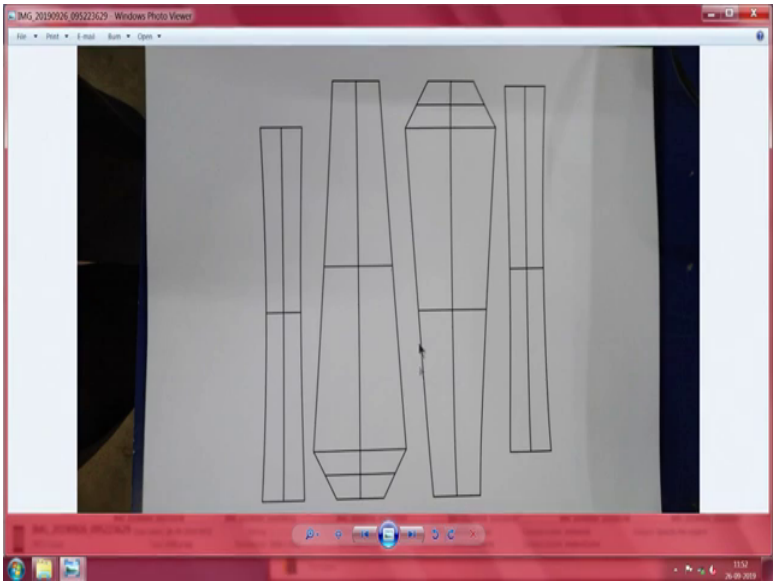

And these have got printed because the that particular cad package we have identify surfaces only like this, I forgot to hide them. Eventually, when you hide them and make your own device most likely we end up with very very useful thing, you have noticed this.

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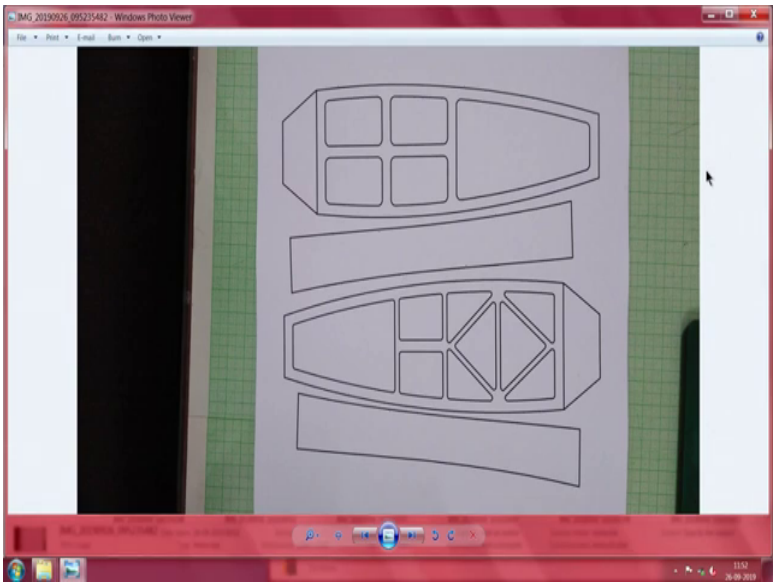

This side is towards the receiver and this is what is in your hand and the way you put it I have two big case which shows up and down and probably one of them can select one of the functions other can be selected, it is facing the other way. Contrary to, normally we have them facing reverse and a lot of these faces wasted and then if you take any of the ac remotes you will notice that the keys; keys have been made for the operation of the or layout of the printed wiring board not so much as the operations.

And now, I have here something it just the other way; one face looks like this, other face of it is even simpler, I just have four keys. Just wanted to show you the way we can manage various ways of layouts, these are the actual pieces that have been cut. And the main advantage or the feature of it is, very easily this whole thing can be passed on to a eventually to a laser printing machine.

But the first one, since you have done everything and you have not lost anything you can probably play around with the cardboard, have devices like this and decide what type of a this thing is required here. And in fact, if you make it on a cardboard thick enough, its probably very easy to even populate this have a display also at the back you can have a polycarbonate or acrylic window. And the acrylic window can have a mask, which shows various things what you want.

So, I am trying to take you back to a time when all these original industrial design and model making was made by hand, not long ago. Before we had this, I think all our laser printing all this stuff you know; I mean 3D printing and all is probably not more than 20 years old. And we have been having one semi professional things around 10 or 15 years old.

And you can easily do all this, by using the best available software package on your pc and then taking it in a printer, preferably home printer or in the case of your campus you know, you probably have somebody who does in where I am making this lecture it is called the campus Xerox.

So, we know very well Xerox is not there, so campus photo printing. So, you can take it to the photo printer print everything and I have just been told that, the local photo printer which is available nearby can also print all these materials up to 200 GSM paper which is nothing but a thin cardboard. And one of them is able to give us three hundred GSM also, that is as good as you can make a whole circuit just getting it made on top of a what you call made at home printed.

And again coming back to this display, I can easily rearrange all the components and we can try out various things, there is the reason why oh I hope it has come here where is it; where is it; where is it has missed, but I am sure it is hiding somewhere. You see here now, which I thought I will point out this one was intentionally made flat pieces. So, that for us to learn how to make it is next to this one was the next one, I have a trapezoid l cross section here, then I have a rectangular cross section the same trapezoid has been inverted in the other side

and what is called a lofted surface has been made. This lofted surface has a twisted curve, followed know.

The advantage of such a device is first of all it is symmetric, this what I had shown you earlier. And the keyboard layout I can play around with it the way I wanted and most important is, this cannot be made by either 3D printing or laser cutting. Because if you take a thick sheet it does not take this twist easily and 3D printing give you a steps.

So, now I know at least one place were printing it out on a what you call thick ah raw material typically about you know up to 0.6 millimeters PVC or something and then giving it a gentle twist like this, it has very smooth feeling about it.

I hope you have you appreciate this, the same thing has been improved here such that you have this can you see here there is a gentle slope here everything gets comfortably. Two options; one is it comfortably in the hand other thing is I can have any layout I want which I can try. And actually, when you are trying to arrange things it is very easy for us from building up a materials library.

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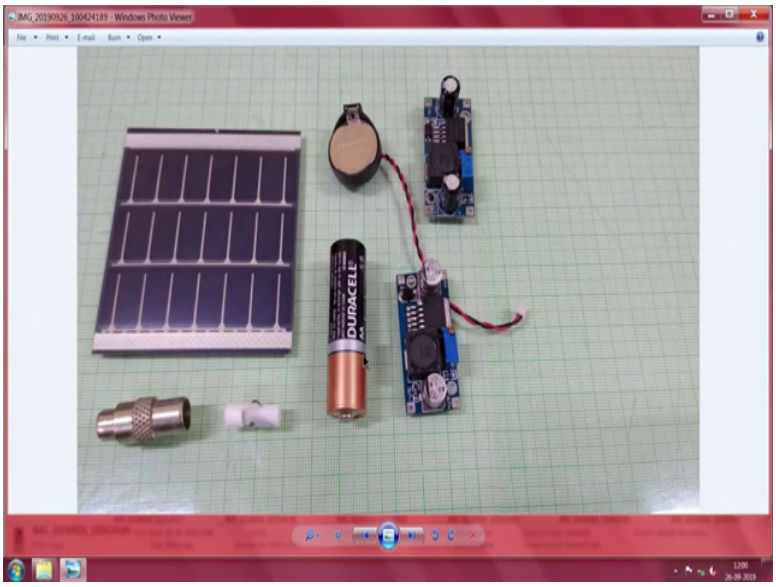

All this hardware items you have the hardware items that is fine. If you do not have the hardware items it very easy, I think you know what it is; it is a small hinged standoff or a support piece where which one goes on to one chassis another it goes on to another some circuit or in case we have more of them it can be stacked say base plate first PCB one more of these device is second PCB, so then it can be made to open like a book.

And now you will see that its very very convenient for you for the at least first round when you can get all this printed out. And the fact that this whole thing has been put on a graph sheet and pictured in this case. Because this a there is a glass underneath the graph sheet is there measuring scale is easy. And after you take a photo print of this you can always, cut them and use them as your templates.

I am sure some of you will know about it, this is the coin cell holder. Coin cells are very flat and the diameter is big, typically, I am not able do it. Probably, it is a 20 25 or 20 32; 20 mm diameter and around 3 mm height. Button cells look a little like a button the heightened this thing lr 44 and all that come under that.

So, this is a coin cell button cell and then you have all this tubular cells. All these devices the, if you go to the manufacturer site you get a direct picture of it. So, all you need to do is arrange all of them in a piece of what area in your computer and then make a template and keep it.

Now, your question is sir, I have an old thing or I have a new thing. Their disadvantage if you have a new cell like this if you do the mistake or trying to measure its dimension, you may create a very explosive situation, seen this know is a metallic object should never do even the by error you should never you know try to put it inside any of these live devices and then try to take a measurement.

I am not saying I am a genius or you know anybody who is listening to it or not careful, in our enthusiasm we may miss something. However, next comes why cannot we use a old I mean old cell like this, old cells leak and then it is going to be a new cells instead. If you just make a plan b or side b and all that you can arrange all these items here, the graph sheet.

And you can probably end up with, even before you make the final device you can put all the you know side this here the frontier the top here and all that and your final enclosure is ready and that can next to be sent for any further prototyping operation. Typical prototyping operations also include other than 3D printing and so on various other things. I will stop this particular presentation this time at this point, we will go on to a new topic next time.

So, thank you.