Enclosure Design of Electronics Equipment

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Lecture - 10
Enclosures with detailing: Examples

I expect while you can start directly on this lecture you would have seen the earlier lectures at least is summary part of it towards the end of what we have covered in all this; this is part of the course covering how to convert an idea mostly electronic it is circuit to achieve generally you can do the analytical part and you can probably verify various things which are there on the internet various resources that are there on the internet and eventually make it into a product that will have a unique appearance or a physical existence for it a circuit is still a just an interconnection and something which proves a little bit of your intent and various you know options about it.

But then a physical product has to exist in reality with a harsh environment; the environment can still be benign as it is when you use carefully by a trained technician or by yourself or a single operator and extremely harsh where it could be dropped intentionally it is kept under water intentionally it takes a lot of beating and. So, on, but that is more towards another 4 or 5 lectures away from here. So, far I have been covering things which are a little related to what our students have been doing here in a department for the last about 25 years.

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So, now looking at my; this presentation, I went through in detail about this a device for us to check or calibrate an auditorium and very rarely of course, what teachers would like to do very rarely is the teacher adjusts his level of speaking intellectual of course, yes students are much more intellectually superior or whoever the knowledge seekers or superior this is only about the audio audibility at the back of the thing.

Now, one of the important thing is a sound level and comprehension are not about the same something in between is called the volume units volume units are nothing, but sound pressure level which has been adjusted depending on a human voice and typically again you have various curves which we talk about frequency versus level and there are threshold curves and curves which are of equal loudness about it. So, this is supposed to vu meter volume units are slightly different from the other meter.

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So, this had explain to you in detail next page this is eventually a this whole concept here you will notice that there is you know that there; there is this beautiful concept and then it has been implemented we see we have a product which results from this and in this case it is organic also.

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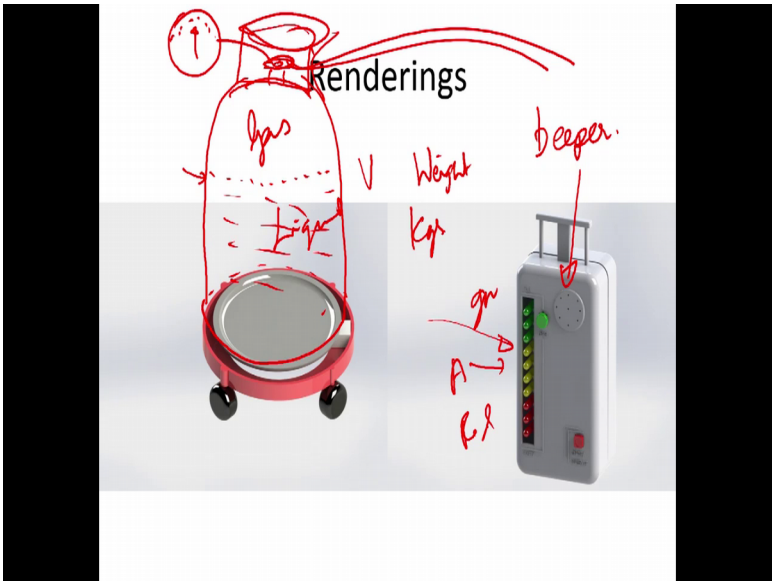

So, I have taken you a where an extreme example I will take you to other examples which are common place this particular thing of course, it has a little problem from the legal point of view one of them is that over here in India we use bottled LPG that is

liquefied petroleum gas the problem about any liquefaction is that very rarely the pressure changes if you take a I will try to draw a picture of a bottle here.

This is typically how LPG bottles are in mark as a call it a cylinder are used only in environment sometimes it is under the kitchen counter sometimes it is outside the thing the issue being that there is no way of fitting a simple board engage or equal end meter which will tell you how much of gas is remaining because any time if this was the level of the LPG inside this part will be the gas this part will be the liquid and it is filled under a pressure which will ensure that you have a constant supply and then this device which is there on the top is called a regulator and this regulator ensures that the pressure which is there is you know lowered a little and then it is supplied to the cook top or in our case now we call it a burner.

So, as such this pressure is constant all the time only thing that does change is the level of this and then consecutive this level we have the total particle volume and quantity which is proportional to this that is I will call it here weight let me not go into the thing about saying is it kilogram force and I use Newton's and why all that because over here we just go by kilograms directly that is what everybody understands and I think some part of the world they have the pounds and then I do not know other places the issue being as the gas is consumed the weight changes that is the only physical parameter that can be easily reliably measured there are other things also saying this meniscus is usually a little cooler than the ambient to because your operation gives taking place here.

So, there are LCD strips if you stick the strip on the side and all that it is I mean it supposed to indicate the liquid level. So, coming back here one of the students has come out with a concept which is also existing, but instantly it is not allowed in India saying why do not we have a balance here an electronic balance and this electronic balance has of the various what you called like a things inside to sense the weight of the cylinder and then it transmits to a display unit here this display unit can be put in a place where.

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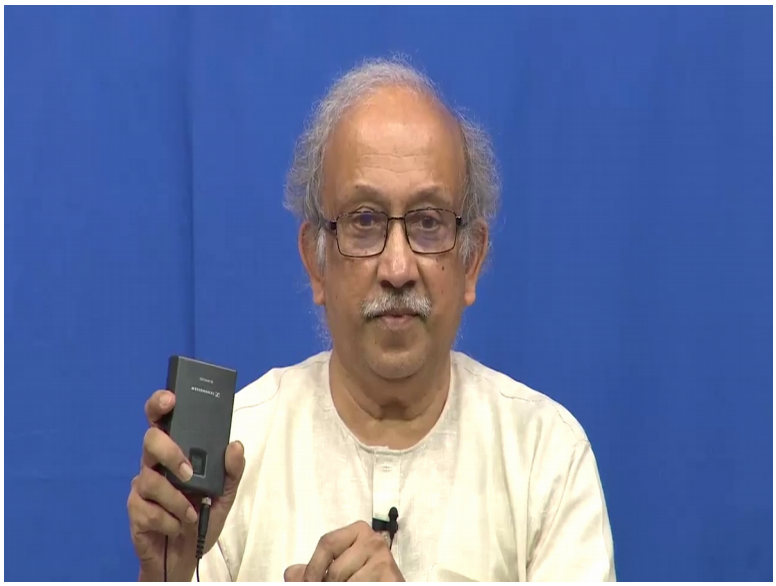

The cook can see it at there all the time or only when you query it you can put it whenever you want you can just see the display like you press a key imagine if this were the display . So, I press a key and then I get dots on it otherwise it goes to sleep.

In principle its very good absolutely no issue about it plus if you look at my slide again one more time you will notice here that it has a beeper here that beeper can indicate to you it is the preset time yes that was I have a blooper it was a preset amount of liquid that is remaining just like in a battery you have a depth of charge or depth of discharge we can have something which shows there and then we have several other thing we have a knob here to do various functions and then a set of LEDs here you see the way the displays been arranged they are discrete because it is easy to may make them and then at the top level you have green and the middle level you have amber and the bottom you have the dreaded red a little like what you have on a traffic intersection well the going is good and the things are easy this is how inside things look like you see here we have a beautiful battery.

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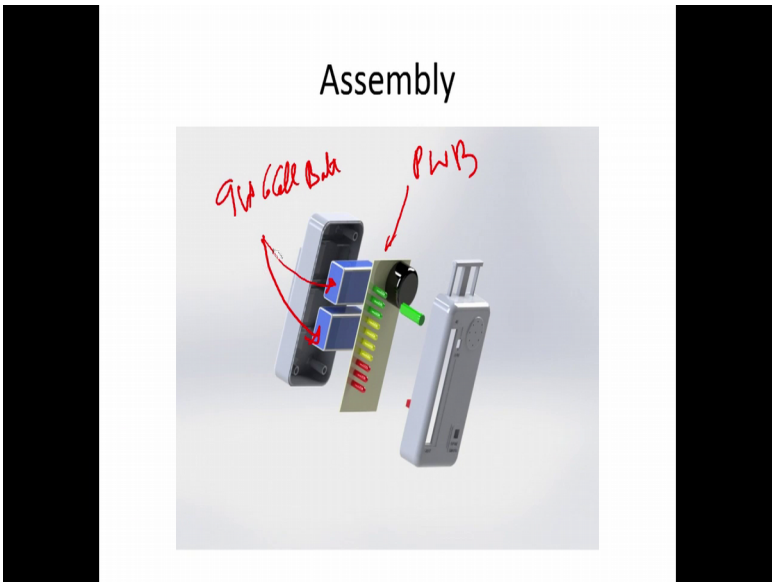

This is 9 volt 6 cell battery and then you have a printed wiring board and then the way these things have been made the moment you open the cover its easy we can go ahead and independently test this device you can put it here and nothing is attached which is where why I wanted to show you here this is fully testable there nothing which is hanging around protocol there no wires attached to this and then if you see these what you call to cells also the cells are probably attached to this either by a separate what you call small jump cord or they can be part of a battery door here and then you have clips. So, those clips will I will try to raise it instead if you ever used is 9 volts battery I think we will know what I am talking about.

So, it is possible for me to use them in series get a little higher voltage or alternately I can use them in parallel and then there is a small connector wire which is there. So, I attach this here and I attach this here and then I am in business it is not very difficult to make making an enclosure like this is not very easy and then subsequent lectures I will cover about how to use a standard enclosure for this.

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So, this is how it is expected to see now slowly can you see some elements of I mean I will call it good and bad good day is it is implementable this particular thing was a load cell it is a beam with load cell which is being which is available in the lab which our students are working you do not need all that right now you can probably have a tray on which you can do it here and then you see in this beautiful look of this; what you called device that is there is more to scale it is also looks a little like the LPG bottle is a safety ring here there is something here to hold it and you can also use it like a handle and then it looks a little like the LPG bottle.

So, in principle we have a beautiful product if we want we can connect wires otherwise we can make it wireless in this case what they have done no discreetly they have taken wires from this taken them out and then brought them here and then they have connected them here.

Later on after a little while yeah I can even see it you know it goes here like this and comes it has been found out that anything where a potential can exist here is manned by safety regulations. So, this cannot be done. So, something else has to be done we can probably make a flameproof or a no explosion proof device which can be connected you know wirelessly to this and how do you get power from it, it should not be powered now we have to use some gives to power system saying we we try to I do a little bit of energy harvesting as and when we need it or it can be a passive FRID device like it when I

switch it off I switch off the gas and what you call turn out the regulator take this and put it near and read the RFID value and all its a little like the small tokens which are issued when you want to enter the metro railway station you have a turnstile and you have this token which I was showing yesterday that has all the information it is not very big and the moment it is inside it does not cost you anything which will take me.

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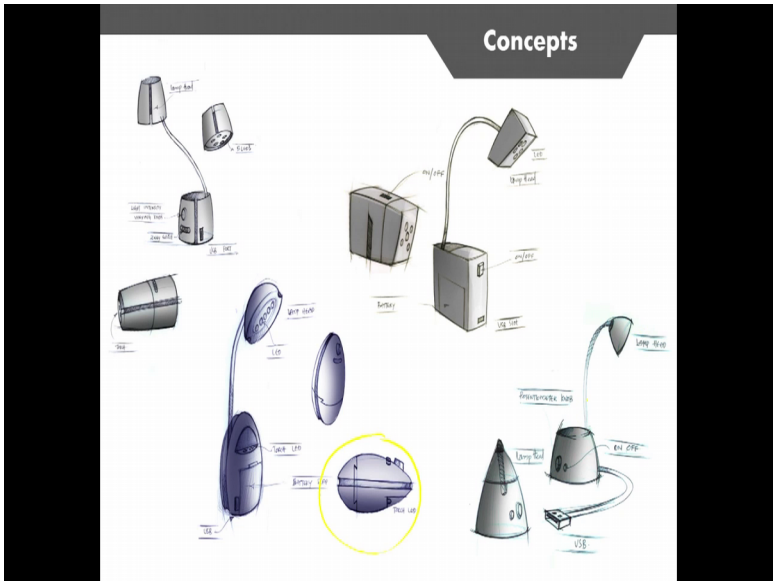

To the next few slides you see here somebody was working on that same lamp which I tried to show you yesterday saying why does it have to look ugly why not something you see here they have got a beautiful what I know I felt thrilled about it saying why cannot we have something like that it should look like I do not know what is that object would I call it an egg and also it is a very friendly stress busting the thing you can even hold it in the hand maybe its soft enough no you keep on like that spongy devices you have and this one know either other extreme saying it looks a lot like a different object then you have something here.

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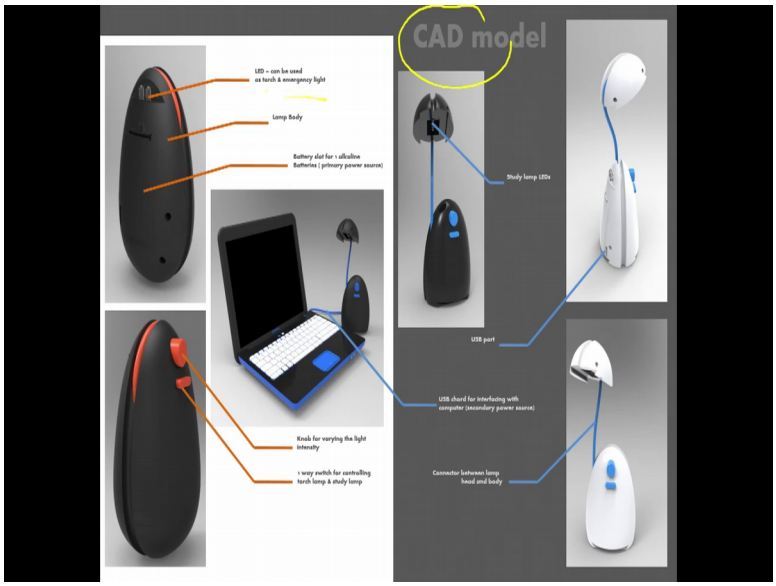

Which looks like a cone and then there is something here which looks like something else part of it and maybe they can be stacked or maybe this goes on top of it here they have made it finally, see this is where the beauties these are all the concepts which we they have worked out using yes it is written I cannot bluff its written using some illustrated package in our case on our premises

Most of the packages have the student vertical licenses or number of places or seats as such our students have access to it then you see here all the features which are there and then you can use it and then see here what all you know you see the colour and you see all the various objects you know after you take it out it just what do you call it stays there without falling off. So, you see here there is a blue this is one combination and then you say there is a red combination and the most important is its self explanatory that you have a dot tail and then you keep it underneath this you can use it like that in case you do not want it you can probably you can use it as a torch and emergency light.

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I will now come to the next to this thing you see here I do not know why they call it a GLOMP; there is a some reason for it.

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I will check with them and get back to you oh they have a beautiful origami based transmitter and receiver I do not know what that this thing is except that this being an open vertical environment and people can try out their various options.

Somebody is come out with a device I do not know whether it is a remote or it is what I call forget me not a whether it is a docking system or anything. So, once when I asked

the student he explained to me that the transmitter is kept in his bag and then here is his receiver one of them which is larger is carried around the smaller thing is kept in the place which needs a vertical I will call it anchorage.

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Instead of loosely tying it with a cord like this you see here I have a huge a cord here well it is all right absolutely no protocol no problem I bought it we have a serious problem often no people walk away with it I wish somebody made a device which will you know where beef me or even vertical zapped me or even maybe you have no other more violent devices to control me to make sure that they are not separated beyond a distance the moment it crosses a distance if I get a beef I know that I might what they call I am going beyond the thing.

So, it is one of those devices in this case because they had to make sure that they have the thing already they tried to make it a little big.

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But the scale is not known here no it has it this had explained to a lot yesterday we have more and more beautiful devices. So, it was also submitted as part as a heck vertical a device for part of this rapid prototyping.

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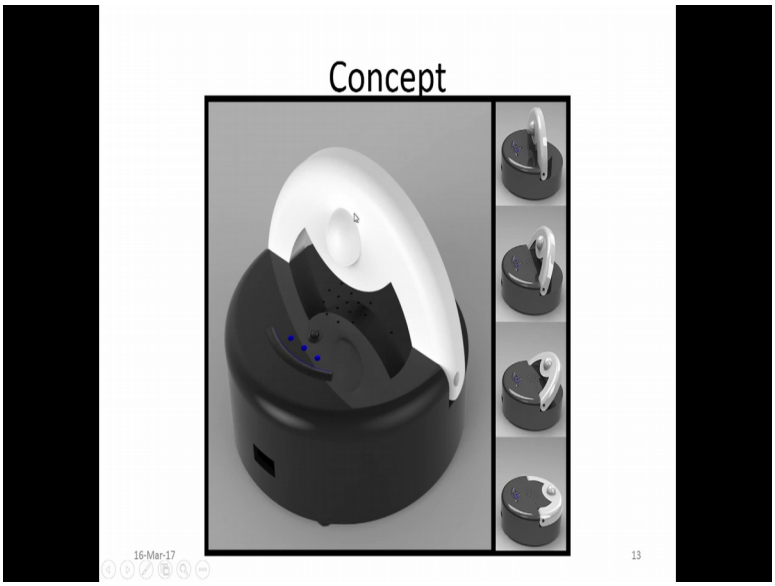

So, you can see it again the good old watchdog I avoided mentioning the whole thing as to why it is called a watchdog in the case of our microcontrollers and all that we have a small issue about it saying let us say use it in a critical situation where monitoring is very very important imagine we have one of these a small micro controller devices which is

attached to patient monitoring system what if the micro controller itself fails. So, we do not know no whether it is a. So, we have 4 conditions something its true something is false true and then we have false.

The condition is it is to be displayed not to be displayed. So, we have this issue of what you call getting a proper thing. So, something called a watchdog timer is usually implemented in these devices in case the code freezes the watchdog timer is a little different level I do not know its high or low the way I do it takes control appetite saying there is no activity and taints a parallel thing as soon as there is no activity we will be able to get an indication. So, that whole thing about the watchdog timer came to them about the saying nobody can disable it the moment something happens and it loses power or anything before then it also says it has failed that.

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So, the word watchdog timer was there this slide I had shown you yesterday welcome back to one of my favourites this Lumi and then the various things they played out with that Lumi here product sketches various operations.

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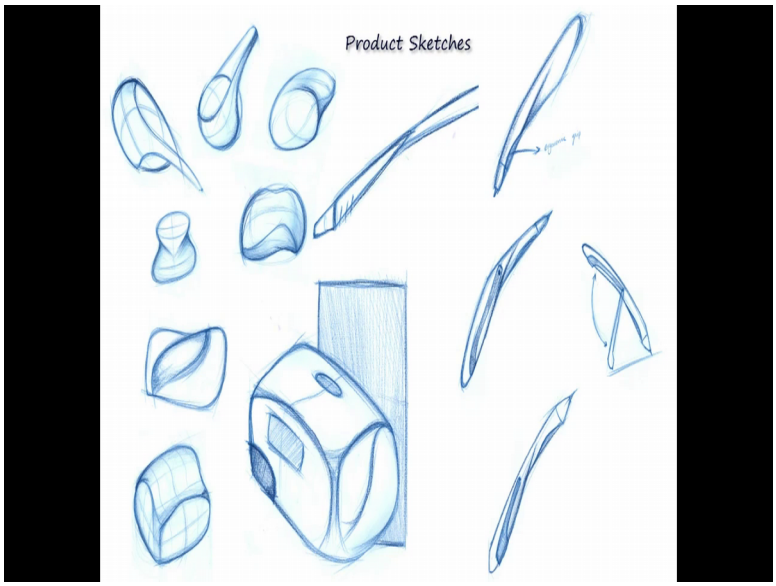

Now let me take you back to a small device here oh good old quill and if somebody says it is a penknife they are not going to cut your pen you can chisel your pen with it all started with people trying to take various type of quills and they sharpen the end and then they dip it in ink pot and then to start writing good concept is it not my our Lumi also is a little like that except that here whatever what I call my good intelligent and very perceptive students you said is sir it looks ugly why do not use something good. So, we had this beautiful very very shiny I do not know what it is people tell me it is probably.

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Whatever what is called a votive candle holder just check up whatever votive what is nothing is probably you know it looks like a fat candle holder and it looks a little like a crystal it is actually a glass it was just polished and then something from another object has been attached here in top then we put this I have a beautiful a quill device looks a little like a quill is it not.

This of course, is a novelty in the moment you are located you will think good idea the concept is good another its practical and all we will come back to later the earlier pictures I have shown you where about it. So, if you see here in the product sketches people have spent a lot of time about how to make it look important.

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I have shown you that origami this thing as I said I have no clue what that device is, but then this student not he is fascinated by origami and the beauty of origami is that there all planes and by simple folding we are trying to get objects we have a boat and then in this case we have I think all of us know this and then we have this beautiful small baby elephant then we have other various I mean depending on how he are do it now.

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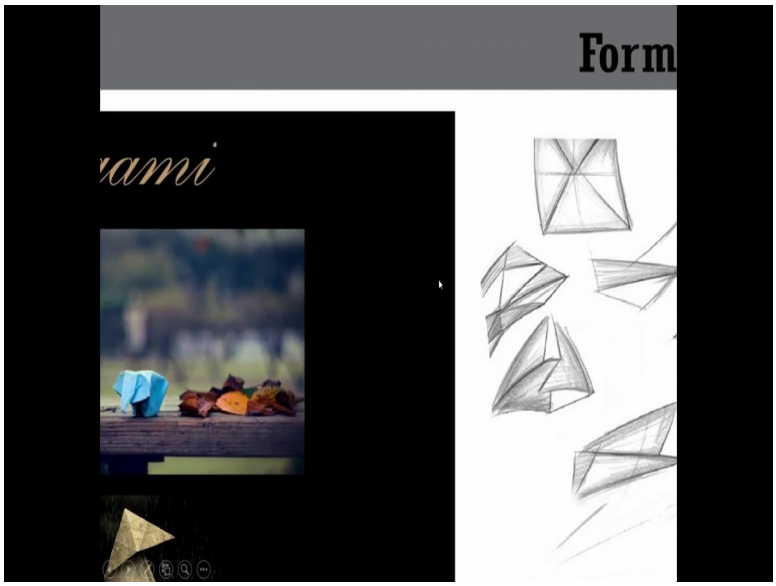

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So, he has developed an all these themes saying let me make an object which contains the various objects in it because he is fascinated by planes, but why a plane just a plane why not organic and why planes one of the beauties here you notice a (Refer Time: 23:11) well at organic structures are they are not that easy to reproduce in case you want to make use a what is called at a cardboard or a sheet metal because by definition a sheet is flat and then any other modification involves you know different type of manufacture and all that making these things is very easy for us depending on if you oriented properly and. So, on no it is easy for us to make a inclined plane and something related to it again

I will take you back to my this votive candles stand. So, if you see this votive candle stand here you will notice that all these planes can you see two of them are shining a little there are plane by definition they are plane and something by a very important thing.

Their elemental triangles the advantage of an element triangle is in space if you have to have three dots dot here dot here dot here this can always be joined in a plane any three dots can be coplanar I do not know the full mathematics and then my apologies for my ignorance and even if you take a mesh all meshes are made in our computers exclusively by breaking them into triangles.

So, the moment I have an object like this here its constructed of basic triangles and the advantage of it is being planar finishing it is easy all you require is probably I have flat surface a little bit of Lumi's powder or related thing then keep on ensuring now something becomes flatter making it cylindrical object like this is very tough there is no simple way by hand we can do it the they are experts. So, people have to mount it on centres and then you know start rotating slowly and probably make this. So, two geometric primitives one is a cylinder or anything with a centre which has got a axis of rotation.

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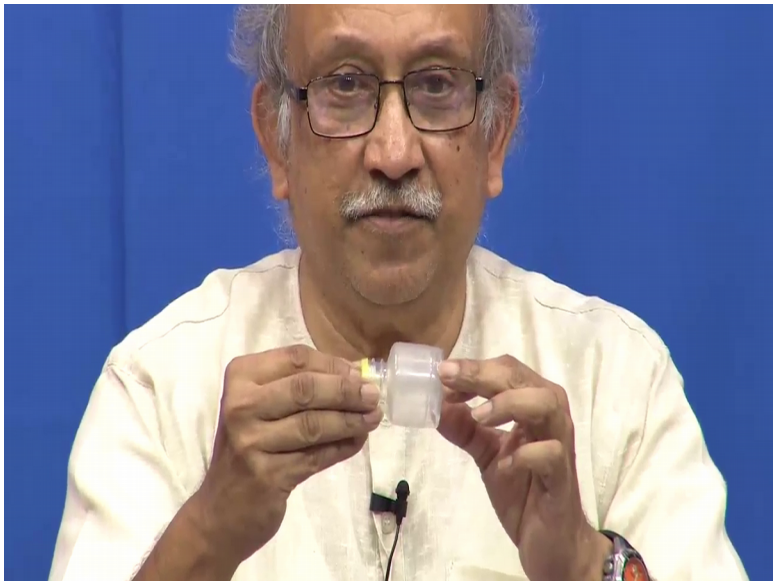

And other thing a flat plane can always be polished easily. So, this student went around playing with this flat pill in. So, he says origami I like it I enjoy these things.

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Now, coming back to this next thing is also one of the exercise I had like to give why cannot you make it torch; torch looks simple, but then they keep coming more and more and suddenly you see that there are torches and torches and when you go to medical you suddenly have all the sorts of endoscopes then you have keyhole you know surgery devices then you have we know something which is sent through the various places here and then try to see inside.

So, if you see all of them know I have two parts of it one of the illumination source the other part is the actual place where the you know the area to be illuminated various operations and also there are torches and torches; torcher I have about two hundred samples of these I had see what I can show you in due course. So, the student when he played around he says the last torch has not been invented yet a simple cylindrical thing as long as it the short it is, but if it were long; obviously, better form is required. So, he has made one here the same thing is kept lying flat here and then he has made something to me it looks unusual that is all I can say. So, I will stop here.