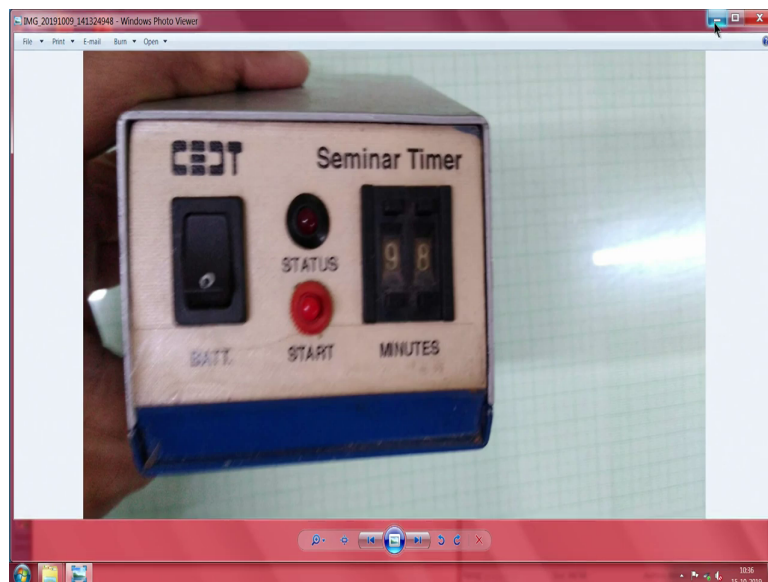**Electronics Equipment Integration and Prototype Building**
Dr. N. V. Chalapathi Rao
Department of Electronic Systems Engineering
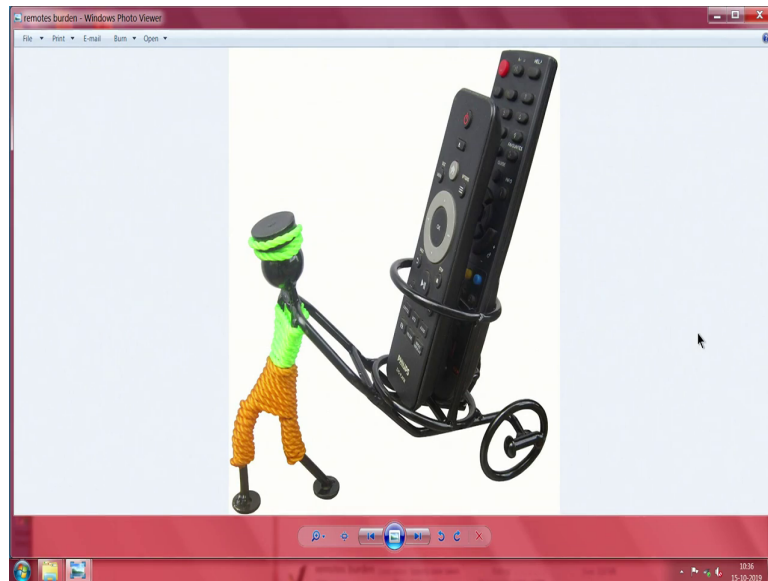**Indian Institute of Science, Bengaluru**

Lecture – 09
Details of Displays and Keys

Hello let me start from where I left off earlier; the exercise earlier was how to make a small box of a handled remote.
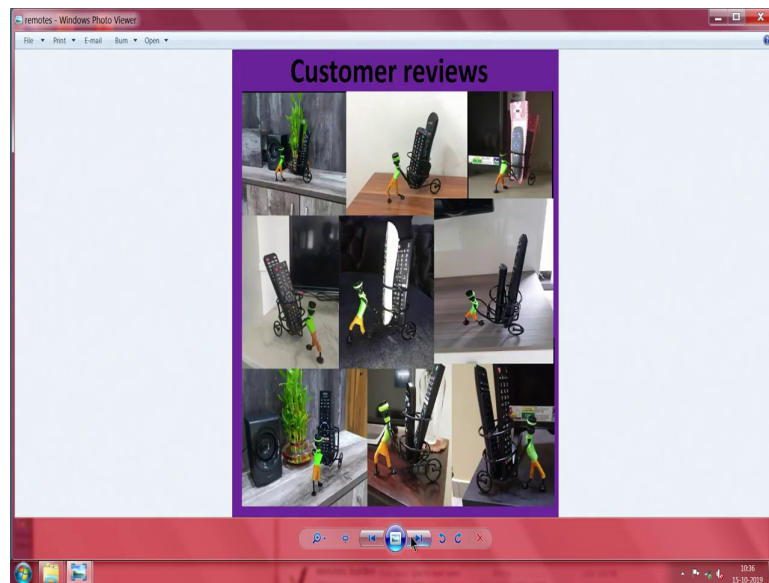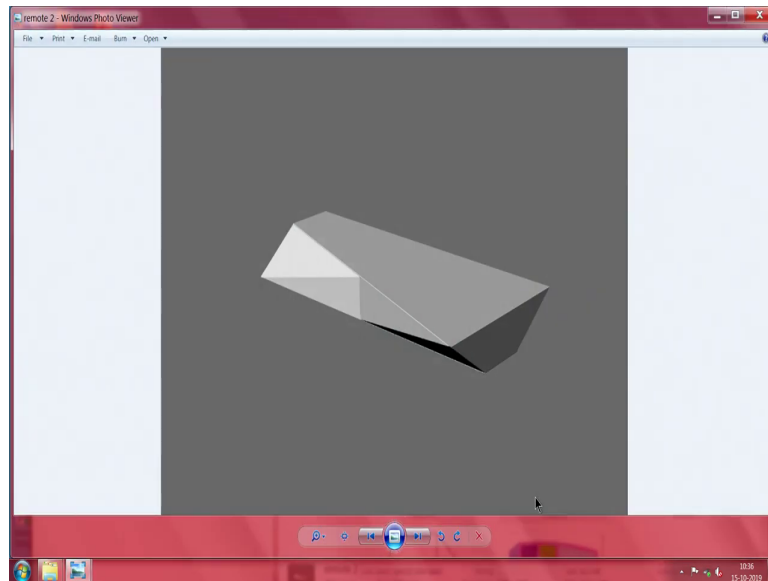
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And what triggered the remote exercise is this; you have seen that know, we do have a burdens of remotes everywhere that just too many of them.

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And it is really difficult issue and you see they just unbelievably complicated. Here we need to find out whether do we really need to have everything. Hence I had taken you through a large exercise of saying can we make a small remote control, ok.
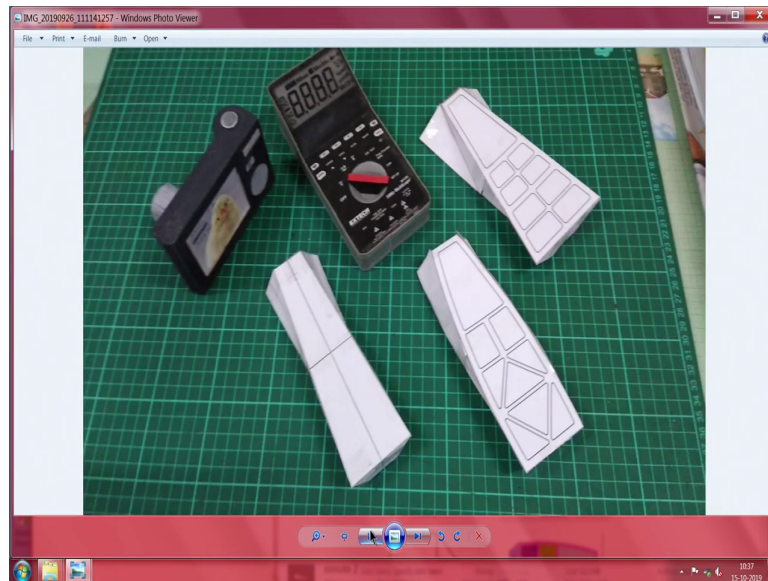
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Then when we make this remote control, you will notice that was the thing where I have left you a last.

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You remember this was one of the remote controls and then I had taken you what you call through a what you call a walkthrough saying; how to make a cardboard device simply at home and do not need to go to a professional printer. And contrary to popular belief; home printers still do not do a really good job. Now I will start this time with a slightly different device. You see here, that is a seminar timer meant for students.

The idea being can we make something such that, anybody can make it. And why a seminar timer, because typically this is what student shall be very familiar. Now if you look at my display; one of the first thing is at the background we have a graph sheet.
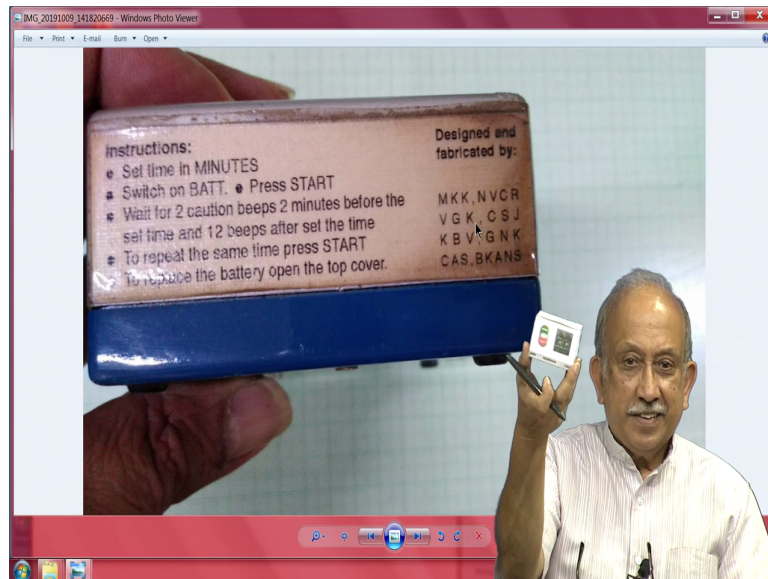
I thought I will show you the seminar timer and all the things. So, at the back, you see a big large group of people who are working here; that is me, this is the industrial designer we have, this is the graphics and user interface designer, then he is the electronics engineer, then he is the P C B maker, then we have the vertical assembly person, and then we have two people who are from the sheet metal shop.

This is where I get into saying we probably need to make a simple cardboard rendering, so that before we end up having to get into fabricated, we need to pitch our idea to somebody. When we pitch our idea, if you are just to make a PowerPoint presentation, it does not sell that well; nobody has the patience that is you see too many power points. However, if you have a simpler 3 D physical model, people will invariably appreciate your effort and choose one of them.

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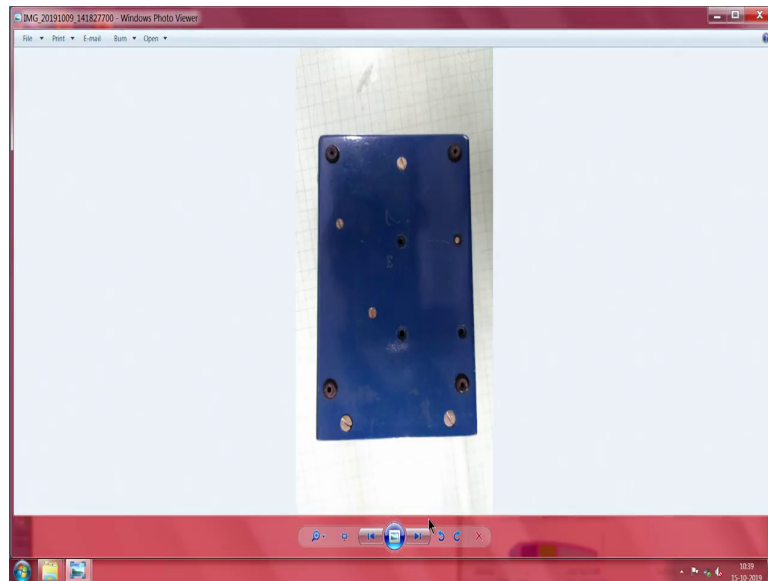
If you got the another way of this device, you see here this is the bottom view and still we have the graph. This what I have shown you in the front; one of the first thing is you will notice is, this is meant for a student's seminar. In the case of a student's seminar, generally total amount of time number of students I have to talk is fixed. So, typically a most of them fall under around six people to the hour or five people in hour which will be 10 to 12 minutes. So, if you look at my display; there is something here which says of course, that was a mistake, because somebody played with it, typically around 8 minutes will be there.

So, if you see at the back, see this beeps before minutes and then rapid brief I mean what you call beeping after that. Now the thing is how to layout the front panel; laying out the front panel is not a that easy job as we think it is. There is still a lot of time involved in it. One of the first issues is where do you put this mark and what does it mean and what does this mean, ok.

And what is this zero, what is this zero doing here; does it mean is off, does this mean is on that is where know; we need to make something to make sure things work.

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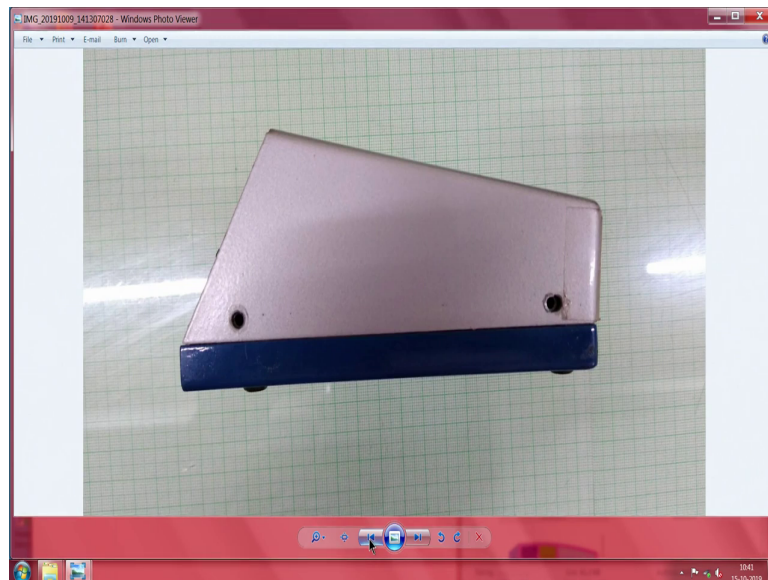
Now, comes to the side profile of it saying; you see this instillation. Here in this case it is seems to be approximately, now little less than 30 degrees; so where a person sitting on the table and looking at it, it makes sense. And other data I should like to notice is probably I have seen here; there is a oblong hole here, but while there is a locating hole here.

So, this is traditional in any of the mechanical assemblies saying; we need it, because we want to ensure that from the perfect point of view any base will fit any other cover, seen that know.

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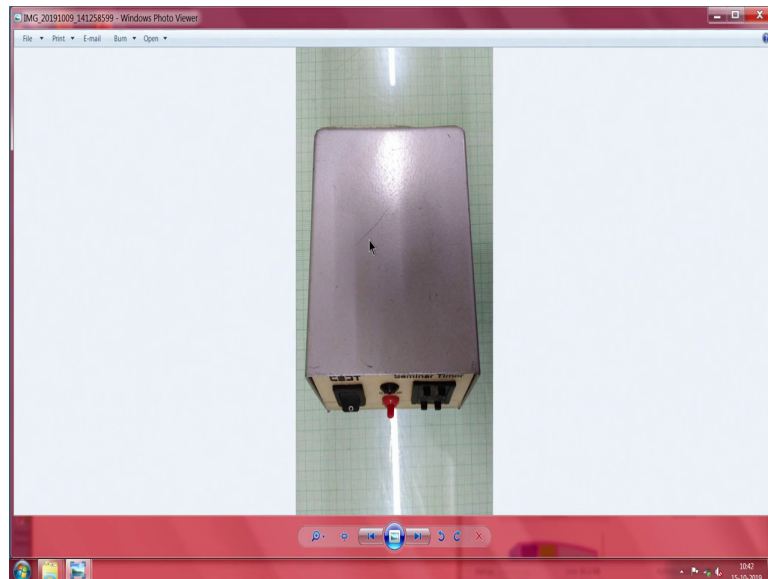
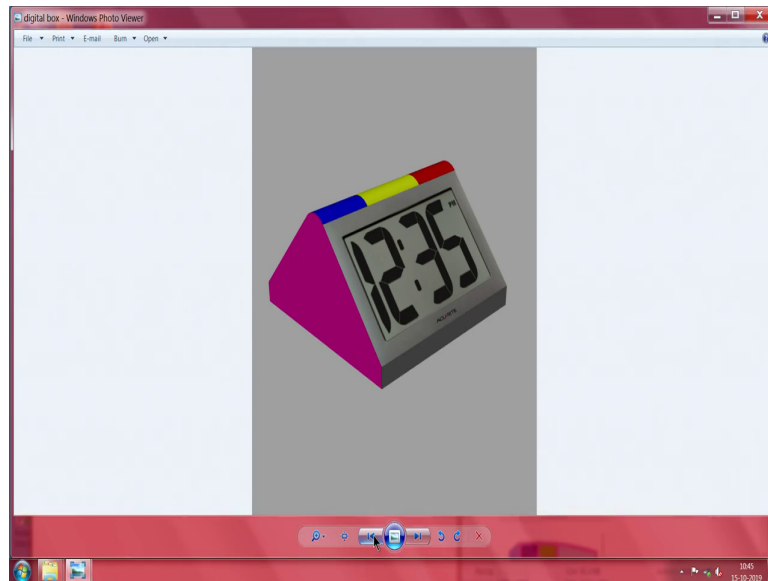Now so, from the top say, little easy and not so easy also. How should it look; typically on the table this is probably how it is going to look. It does not look very elegant, have you noticed it first of all; because in the beginning if we had made prototype, I mean sorry before launching the prototype we had made a small cardboard enclosure and made things, things would have been easier. Now have a look at this, which was made earlier.

If you look a little closer, you will notice that sorry let me shift hands; you have the device which sets the period up and down, then there just one what you call button, which just says start and stop. And most important is we have seen this red colored thing that is a typically a tally light; you would have seen this tally lights on cameras and everywhere saying recording has started. And right now of course, several of our new in the new this is, but what you call a new economy things are edited.

But when you are into news gathering, when you are into regular video what is called a camera chain will be there; usually a three camera chain is normal end. The tally light tells you that the device is on; if we had made it, this is after that done, this is done only may be last few years that was started. If this was done earlier and presented to the team; then we would have known saying what type of keys are available, what type of a sets switches is there and avoided some of the things here.

So, if you see here; when you see it the person there outside has no clue whether it is running and what is happening. So, I would have loved if we had a tally light on top of it and you say this is here the switch and it has battery and conventionally should it has been reversed; zero means generally stop or is at run; line means is at you know is at in is at in and out or anything this clarifications could have been avoided. And we have a little issue about should it be on top or what does this mean, should it be where.

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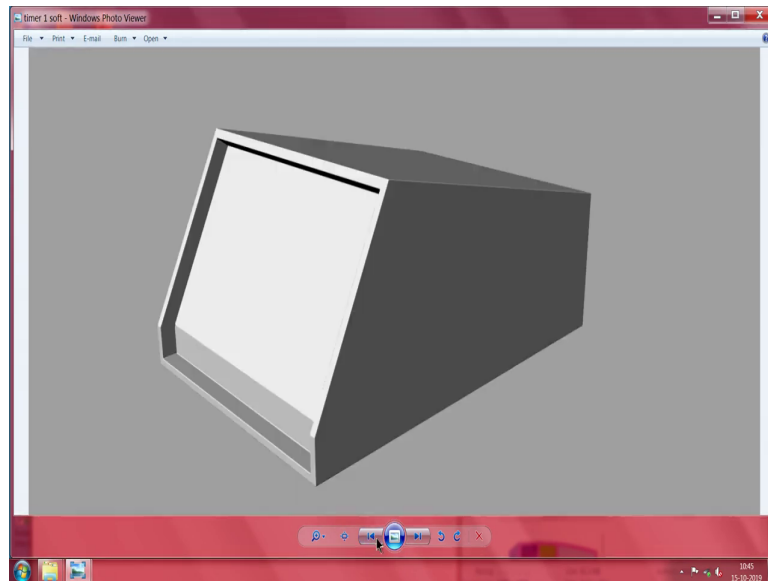
Now, you say the, this typically is development for the sheet metal. After having made the whole device, where we would one noticed that, not very clean; you see we wanted a research here and the back, there is a small error at the back, I will show you in one of this things here now. So, how do we; you see here at the back now if you see, while this is a right angle, there is little some problem here. What are we wanted to do now? All that procession and things have been lost, because of the small problem there.

Imagine if we had made the model as I have suggested before and presented to the team, things would have been different. Now comes the thing, this is a rendered 3 D solid. And the magic is these days there any number of programs which are available on the internet which are partly free to try, or with a limited functionality; and one of them is save is disable after it is work, lot of what you call water marks are generated saying this is done on a trial package of something and all that. So, using one of those trial, these things have been made here, this is

not being saved; after it has been rendered, the screen capture has been taken and saved, so that I can demonstrate it here.

Now the difference between this and this is, you seen here; here everything looks sharp especially this point, here this is small radius. So, this is typically how rendered objects, there is a small you know high light which catches it. Now we come to the important aspect of how do we fabricate this device; when we want to do the fabrication, we end up having this spitted into several parts and try to make whatever we wanted to try in the first place.

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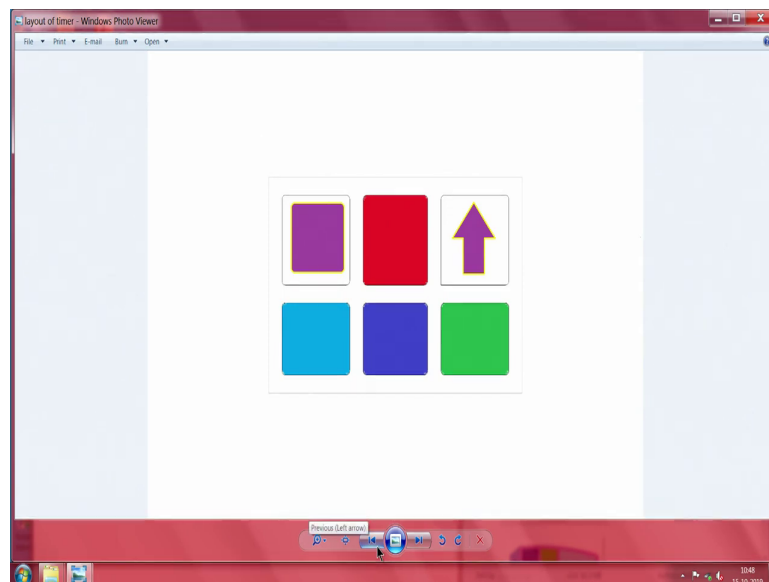
Observe this, this could be the front panel we are looking for, just a concept. Concept has been made, just keep looking at it and you will be able to see here. What does this mean and then what are all these colored things; have they have been only made such that just for being made are they made, or do they have a function. So, what does it all do there?
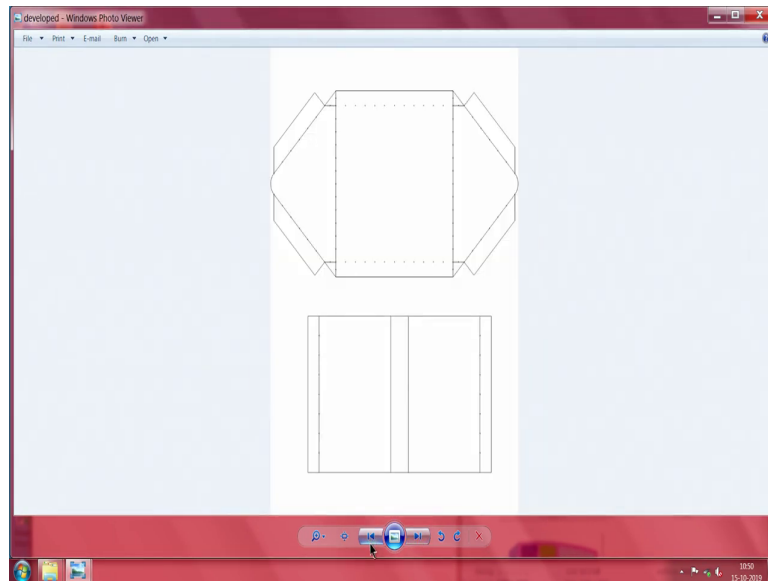
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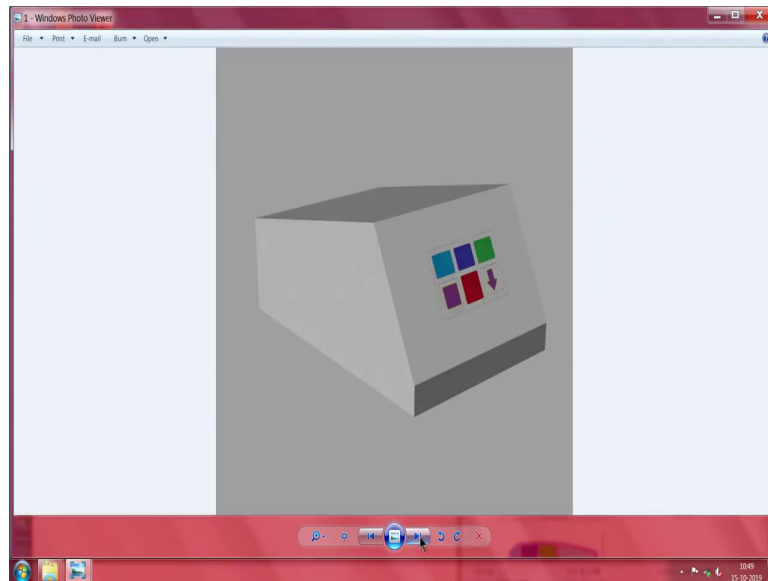
Another equally important thing here is, this is probably if we had made this earlier; now with using our new idea and all these it is very very easy and convenient for us to make a simple cardboard model. And having made the cardboard model, we can now take a call on what should we presented there and do we need that tally light at all.

I will walk you through another model which I will thought which will make sense, this has been just 2 days ago; while that timer what I had shown you is very old. Imagine this is just a box ok; but in this case it is a 3 D rendered prismatic object. Say in the 3 D rendered prismatic object first the thing we see here is one side; there is a digital timer. So, in case this speaker is more familiar with this, maybe we can present this to the speaker; other side we have a clock.

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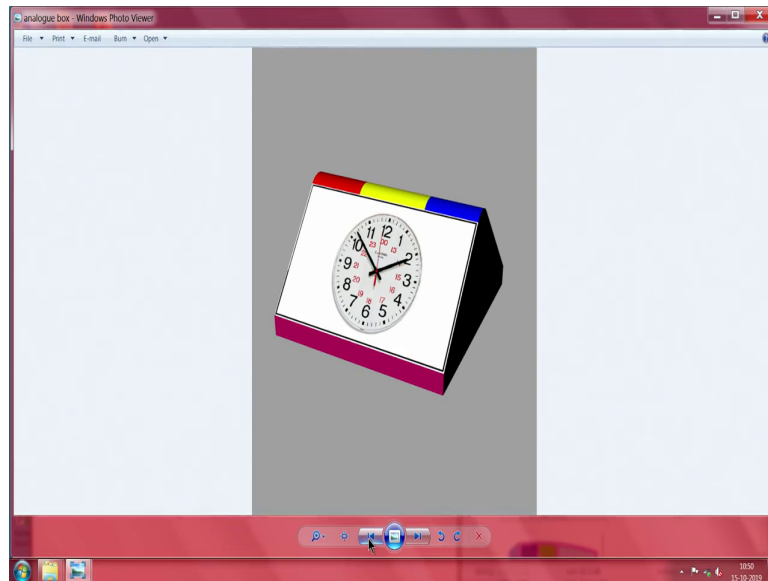
Generally resetting this clock every time like a this thing is very very complicated and difficult. Compared to that it is very easy to set this as a timer and all that end; imagine at the base you have a Arduino and PCB, it is very easy for us to control this. So, this can probably face the speaker. And then you see what look and top know, a little like the police lights we see there; in this just I mean there the just patches. I will call this a patch of blue and then we have the two alarming things; the concept here being, once you start the orange device stays lighted up. So, that has the function of a tally light.

Saying now the speaker is on and then this red is finally, know eventually to stop; it looks smart to me, but I am sure others know may not think it is as smart. This faces the chair, the person who is conducting the seminar. How do we do it? If possible probably we can attach a

real analogue clock; or these days if you have a display, can do it. But I would prefer to make it. And you see here the same things are visible on both sides.

Now comes to the; how do we make these things? See here very very cute and an interesting thing; this is the development drawing. Development drawing, in this case you have base, side flaps, then you have the actual support thing; and this is the top which goes over and these are tabs that hold it top and bottom together. And whatever this rendering I showed you, it looks very reasonably real; it is nothing, it is just something that has been just made in the workshop. And in fact this is not even 3 D, it is just a graphic that is stuck on top of it.

But you see how real it looks like. Now if you this if you where to present it your group like that I told you know, even that small unit had a 8 people; because we had made around 200 of those units and allowed whoever wanted to take one back. So, now, I come to the importance of all; you need to do is check it and print it. Once you have print it, you need not worry it is there at home.
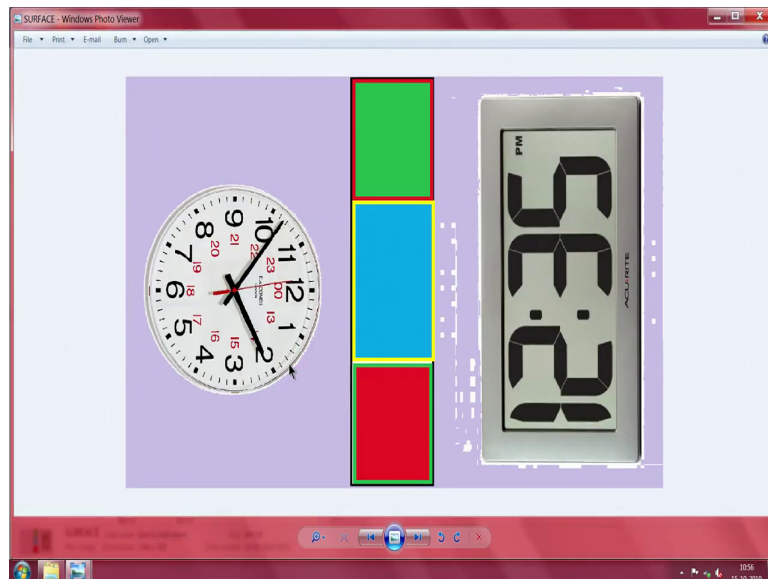
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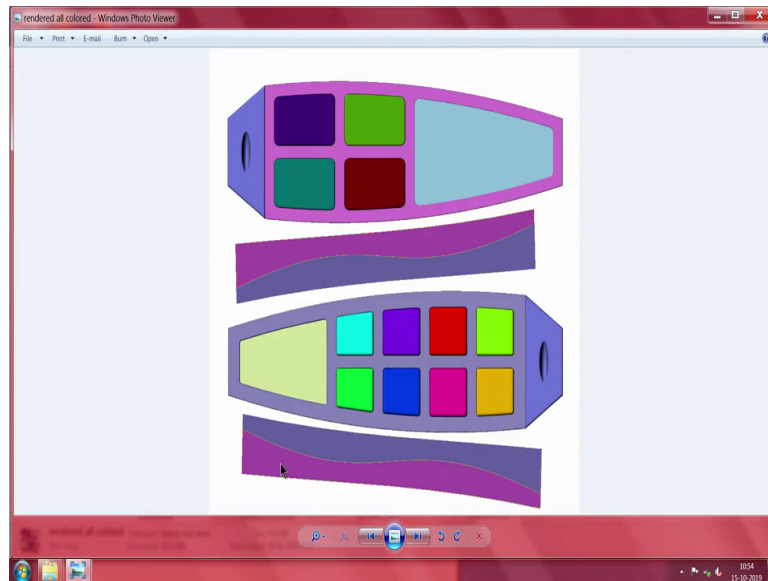
Easiest things to do is this, simple print out; remember last time I had taken you through all these all we need to do is just to get on a piece of paper and we have the thing what we have looking for. I think I showed you this just to say, you just need to press it like this and eventually what looks; not a very big deal for us to go about and assembling a beautiful model which I have shown.

With a being, now this can be taken wherever you want to go and you can just demonstrate it. Coming back to that cardboard model which have made, this is something which can be taken off the internet easily. If you go and look for the device which are likely to see any time; only have to do is just search for it. And usually in the application sheet a one is shown a drawing or picture is given. Or in case you already have the device, just take a photograph. And same

thing here, I just gone to the internet, in fact I have taken this from a one of the clock catalogues.
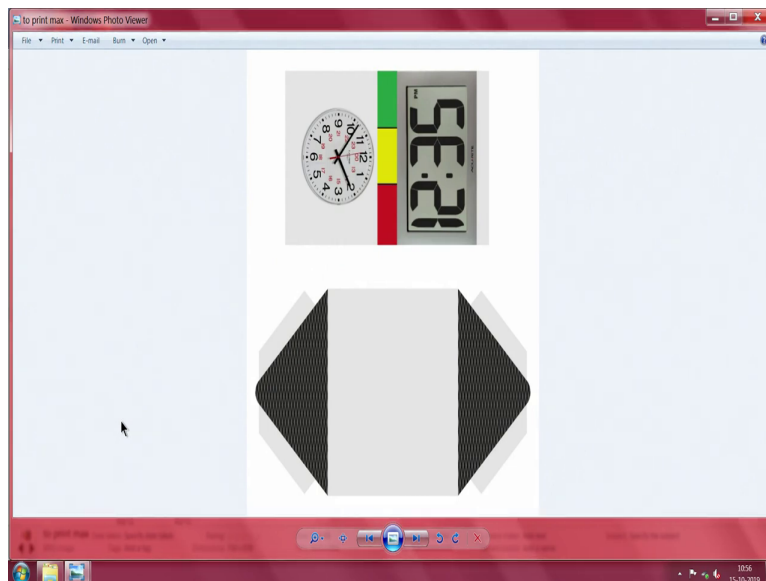
So, I have a beautiful clock face here.

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Now, if we print it at one of the developmental drawings which I have showed you; this represents a top, this represents the face that is facing the speaker, this represents the a chair.

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If you just print it; now there is a photorealistic, photo print that has been taken from the computer; and probably at your work spot, no need to talk to anybody here anything; once you have this, now it is a question of you see here now tabs have been given here.

There is a some texture that has been given to make it look like it is either a plastic or a graph; there is a absolute base in which things are setting and these are what you say sides. These are tabs which will help hold this thing; this goes here, this goes here, this goes on this side and this goes here. With this we are ready; no I am sorry let it tilted like this, tilted comes like this. So, this little curve is there this curve comes here and to make modeling is easy modeling easy, we can probably take a Styron form piece, a prismatic Styron form piece of this much, keep it in the center, fold everything and stick the top portion to this here.

Once you have done this and you can 2 or 3 versions of it. As I said earlier know; one of them has additional display here and normal clock display on other side, alternatively you can have digital on both sides. And only for convenience sake I have just shown this as a small one forth of a circle, nothing prevents us to make it like a nice police light; that is you can have a obliges ferried, that is what we call taken ellipse and then exclude it and it looks absolutely like a police light. Why it is that it is small fun which were playing and saying, you are being chased by time.

I think I am smart, but probably it does not go well; everything is at least that the person there will know about it. And inside it is very easy for us to put all the electronics and then probably put small LED or something which is coming here; and the top full portion on top know can probably be a transparent window with white LEDs all along. And then this window will make sure things are; otherwise you can have a red LED, yellow LED, and then depending on the like green or blue put those LEDs.
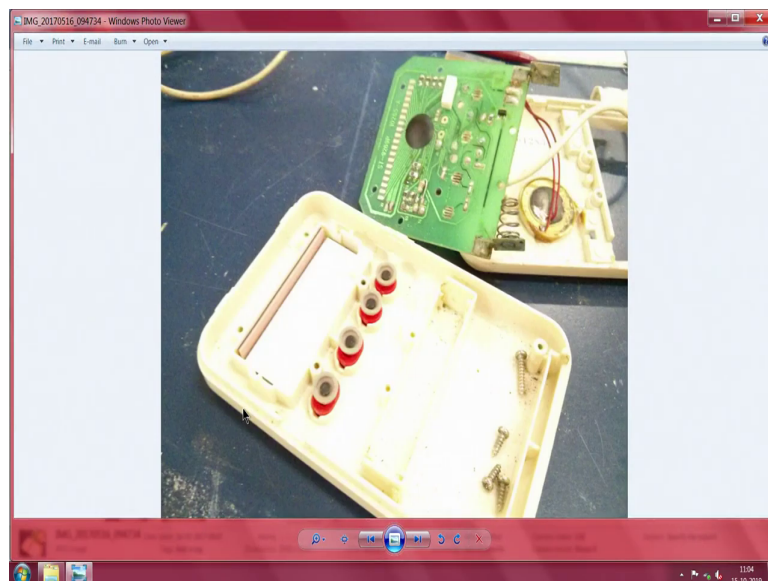
See here once you print this, converter get into a real product is extremely easy which I have trying to say right from the beginning. So, now, if you go through here, we have we can probably avoid this. And just it shows as a burden and a wake I mean the gag is actually we have too many of them; do we need this which also has you know what you call something to go up and down and there are case which shown here and this front this thing also is need there and due to luger on so many remotes in your place. Just one remote is sufficient.

So, it is with this timer which I was talking to about. You can probably it is much much easier for you, just to probably just make one timer and then happily survive. So, in this whole focus once again you saying, how to conceive of a simple product. In this case I have shown you; what could have been a very simple product and eventually converted it into a sheet metal. And if you say most products you know invariably have flat faces, minimum is probably a you can make a triangular tetrahedron with only four faces; otherwise you end up with typically parallel of thing which has around six faces.
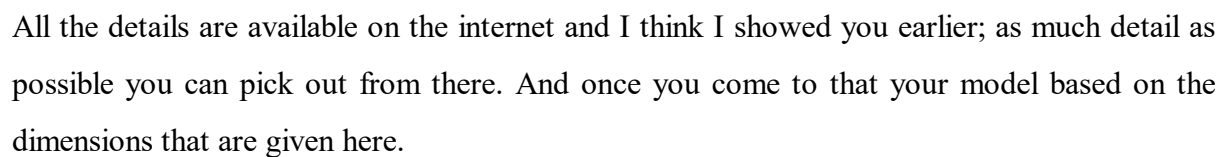
Now, in this six faces having made this, you can take a colon whether to make this whole front base as one, and sides and top as one. And advantage being if you take it out, remaining everything is there; things are mounded here already are available. And in this case we have not actually tried which have kept on showing earlier, it is even possibly probably possible to mound a battery holder in the cover here. You can open the cover and put the batteries inside. In case it looks a little tricky, it is probably much easier to have a tube like thing; and you push the batteries inside and snap the cover which joins the enough of sources, take it out all these can be done via 3 D modeling on your software that is solid modeling.

Then take a printout of all these features directly from the internet and then you can directly show this. And if you are smart enough, you can probably also use it for making all the electronics inside.

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I will see whether I can located it again one more time in my collection of photographs; my favorite is this, this is the kitchen timer which are likely to find at home. So, if you have to have an Arduino and then if you have the display and all that; you can always make this things such that, eventually it will be extremely easy for you to make these things as you like at home.

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All the details are available on the internet and I think I showed you earlier; as much detail as possible you can pick out from there. And once you come to that your model based on the dimensions that are given here.
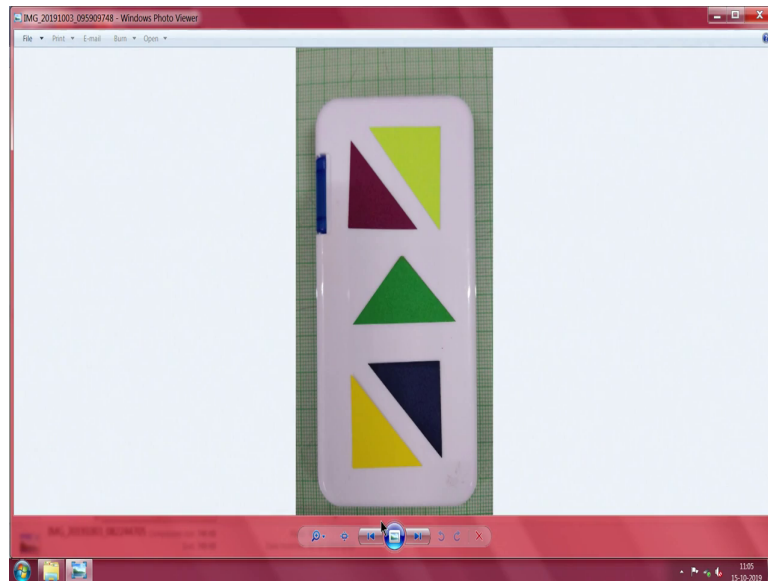
Here total saying this is around 42 millimeter by 67 millimeters and then this is the display. So, probably the triangular face I shown you can be part of this display on one side; other face other side do not need it, you just need to you know stick things.

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And in due course you have actually nice working devices. And once you decide all this probably in case; in this case I have just taken a that I think it is a Mentos box and try to make something what about, but this not a right way of making it for you to understand first time, probably this the easiest way of you have make this things. Having done this; it is a matter of ease for you to go about making anything you want very easily.
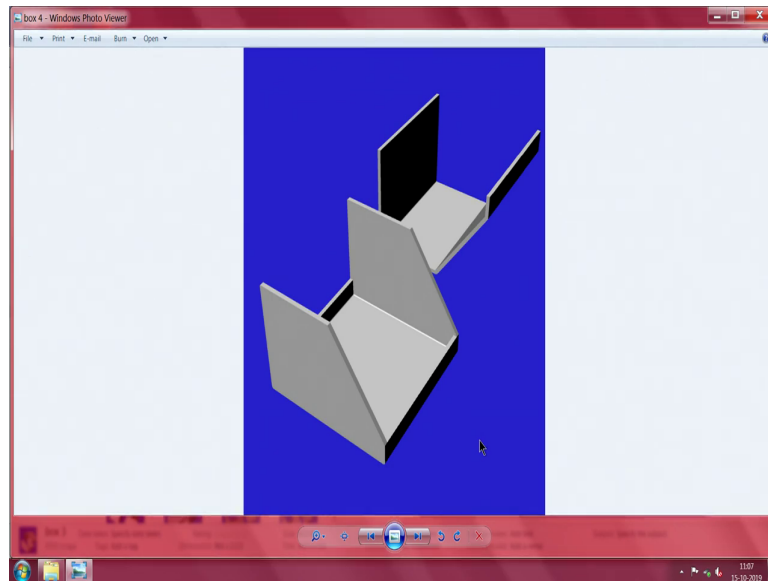
You remember this; see this corner, this is where I thought I stress an important thing. This idea is let to be done by assembling using probably polycarbonate or a clary sheets; and printing an inclined surface like this usually does not come out well in most 3 D printers. And to count first of all, if you see the cross section, which are we oriented, we end up with a lot of support material being wasted and granularity on the front surface. So, you will end up having to fix one more sticker or face applied on top of it. So, the moment you go to all these things; most of these things can be successfully avoided, if you can make a simple what you call rendering on your own.

You have seen that know, it does not have any thickness zero thickness; but what goes inside where and all that can easily be decided on net. So, I will stop here and this is just a what you call how to make a development sheet and all that. Next time will go onto our workshop,

where you can see; first of all very fundamental things saying how do we make these parts, how do you bend them and so on.
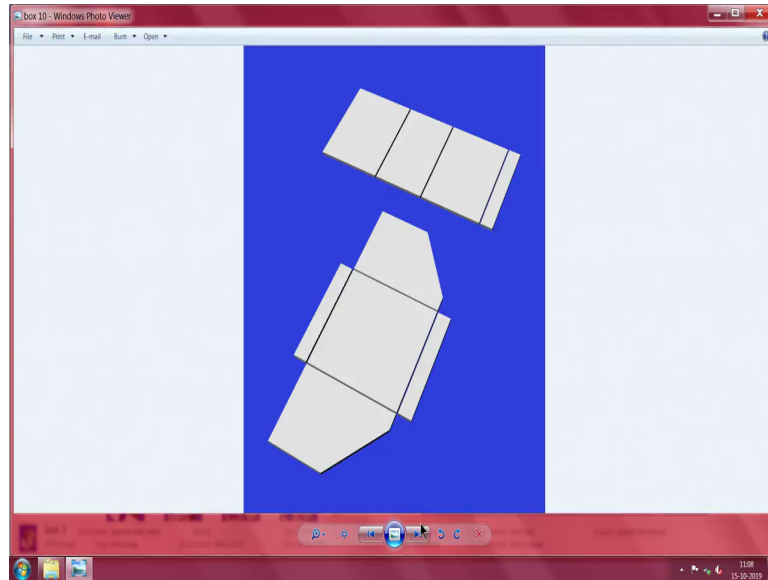
Second thing is how do you make a layout; this is where what I feel is a considerable amount of accuracy can be done without having to resort to skill, what you call improvement of your skill. Your, If you are an electronics engineer, you should concentrate on your electronics; if you are a mechanical engineer, you should concentrate on those things. And once you pass it on for you to try to the next what you call the fabrication, they are the experts in that; they are a tool engineers, they are what you call farming engineers, there are people you know experts in all the operations.

Once you give it to them, they know probably how to make this layout of a sheet, how to carry on the bending, what is the practical thing and how do you get hundred percent yield of

those things. If you get into those details it is a problem; but first time you make your what you call concept very well and present it to them, from there for them taking it is very very easy, they may give a suggestion about it. For you to make it first time, instead of you are trying to upgrade your skill and spending you know wasting material; if you have to make a print out of a developed drawing like this, including in between the gaps they represent the, there is a small gap there can you see.

This gap represents the internal bending allowance. So, if you add all these things and make a scaled drawing; you just can happily transfer this to the sheet metal what you have.

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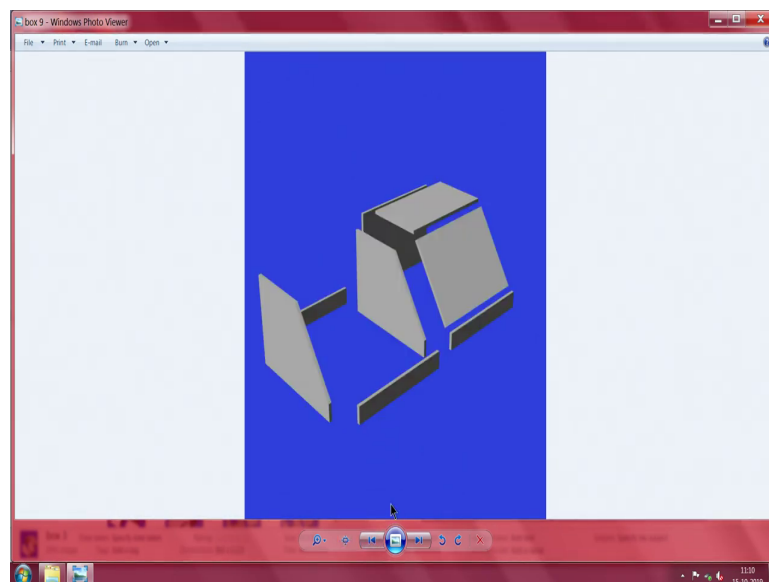
And in case you have plastic or I mean any other non-metallic items, you can take this small pieces individually and take the most important what goes in; this can for example, sit outside or this can go inside. And once again based on that, if you extract these the what you call the

various faces and then present it to the fabricator or somebody easy, very easy for them to first of all estimate the total material that is required.

Understand know, most important is how much material that is required or the scale of operation; up to may be a 100 or 200 like you can manage it, but then if you want to make tens or thousand of it. Finally, all the cost comes to what is the incremental cost of the material. And can you reduce the thickness, then new operations has come are; how do you know fabricated in several other places which is easier.

So, thank you, next session if possible I will try to concentrate on the workshop items. And while workshop skills has been there, and while making drawing and you know somebody understanding the drawing. My next jump is going to be saying, you take a print out, scaled print out, somehow transfer it to a sheet and then directly use it without having to do what we call vernier heritage marking. And then most likely you will have a very very useful first type prototype is very easy to make. So, thank you, will meet again.

Thank you.