Electronics Equipment Integration and Prototype Building

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Lecture - 29
2D flat representation

Hello, let me continue on the theme of how to make a panel layout with components and each component is a actually a 3D solid and it has associated data regarding different types of layers on which they come about. If you remember last time I left you with a small component typically a toggle switch, which can be mounted directly on a PCB you take the toggle switch and it is called lead in hole you put the leads in the holes directly like this or it can be right angle one.

Meaning the switches are this side and you have a right angle thing and the concept in both the cases being there are 3 or 4 layers on which this information needs to be stored.

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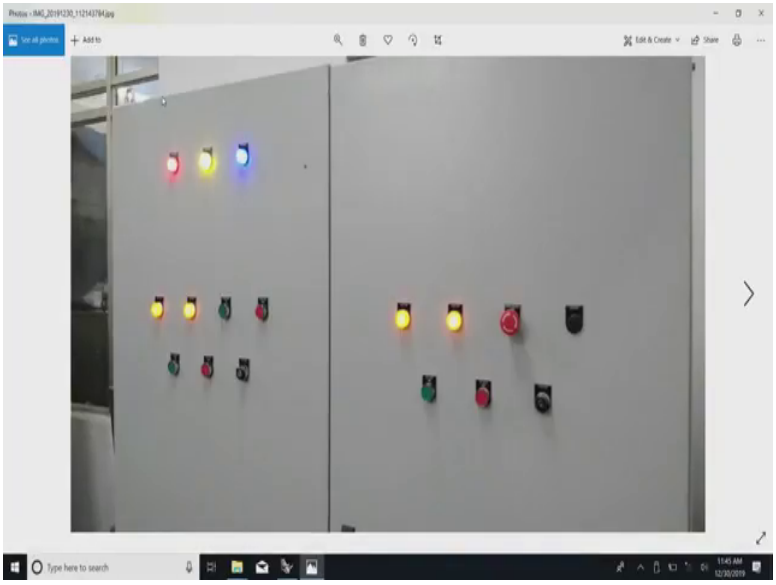

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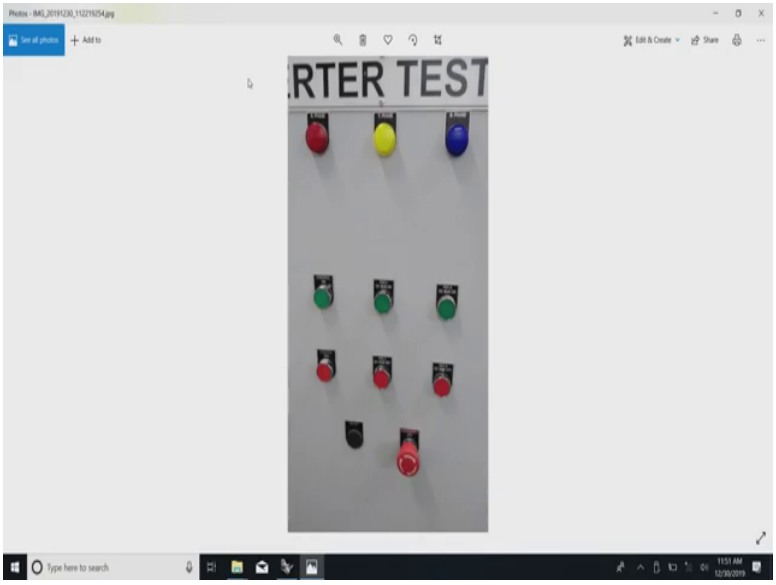

At one extreme if you now kindly look at this, this is a control panel actually it is taken from one of our inverter test setup. One thing you will notice is in this case this is an old industrial device loosely called a panel when they mean it means a power control panel, but the word know that panel is generally used one thing what I wanted to show you is.

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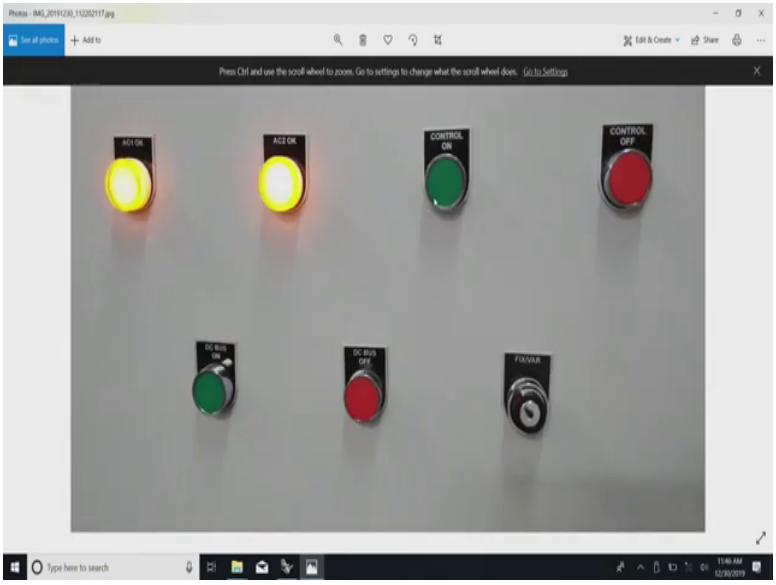

If you see this there are small things which are built into it one of the first thing that is built into it is the designation of the panel. So, you see here if I now increase one of them.

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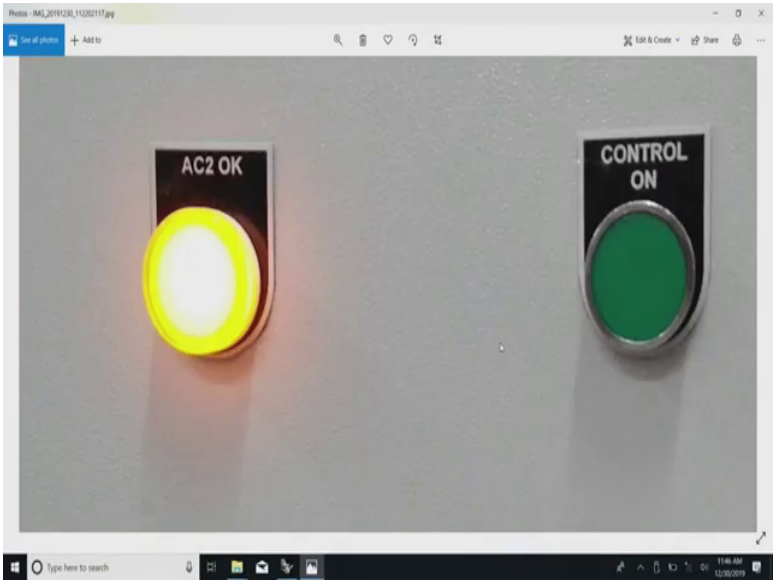

You have seen this very clearly distinctly control on is directly attached to this, now why this is done is often you have a flexibility of changing the associated designation of that particular switch which is mounted there. Sometimes they are all supplied in what you call a generic system by which you already have openings and you need to take the switch and attach it there directly with the along with the key tag the tag will show you what the purpose of the switch is.

So, you will notice here in this case it is only operated by trained professionals in our case there are doctoral students. So, they know very well what is the function of it, but then eventually when it goes into production they might delete a few of them or add a few more of them, seen this here.

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That one was a little close up and you will see another very important reason why I took a photograph of this, though it is written saying it is a R phase, Y phase and B phase only in our parts of the world we have this designation saying it is an R, Y and B. And the color designation is valid, we have a red thing here it is obvious I need not read it again. But several other places you only have a U, V and Y designations or various other designations about it.

Now, in those cases this coloring and all may not be valid the way we wanted that is where you have an option of writing down whatever you want, you can call it U V W, you can call it any other thing or X Y Z or phase 1 2 3 and it makes sense because sometimes our inverters and all work with very large number of phases not just one phase.

Now, when we are trying to design a panel like this suddenly you will notice that the old thing what I told you saying we need a mounting hole on the fascia panel where physically you

mount the devices and in the there is one more I will call it a color or a sticker or a screen print or this thing where the designations are written. If you remember the older panel drawings I have shown you they are beautiful layouts and no components actually strictly no components it is only a layout on that. So, if you see a oscilloscope or a power supply first thing you will notice is these things.

Now, if you next in this case, though the switch appears static it also has colors also coded onto that end there are two designations that is on and off and now if you come and see.

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Here you see we have other safety detailing we just built into it, one of the safety detailing is sometimes either the frequency or the voltage or the option is completely locked out or it is free, we can play with it like this. So, the thing here is that is a key switch though there is a

key though there is a what you call what looks like a normal cabinet lock, there is a switch behind it.

So, when you make these any of these components on the layers and use a solid model for it possible for you to build all these things and further advantage is if it is a fixed large number of thing you can probably replace this completely with you have seen this. We can completely replace all these things with the finally, print the whole thing and put it in a convenient place while in our case it has been put like this you can even have a small remote control or close panel similar to what we saw in the CNC machine there.

I showed you a picture of a fanuc what you call control panel one of them is the horizontal element, one of them is the vertical, the horizontal was a normal turning center, the vertical was a vertical machining center. So, the thing is if you see only components everything they are about the same.

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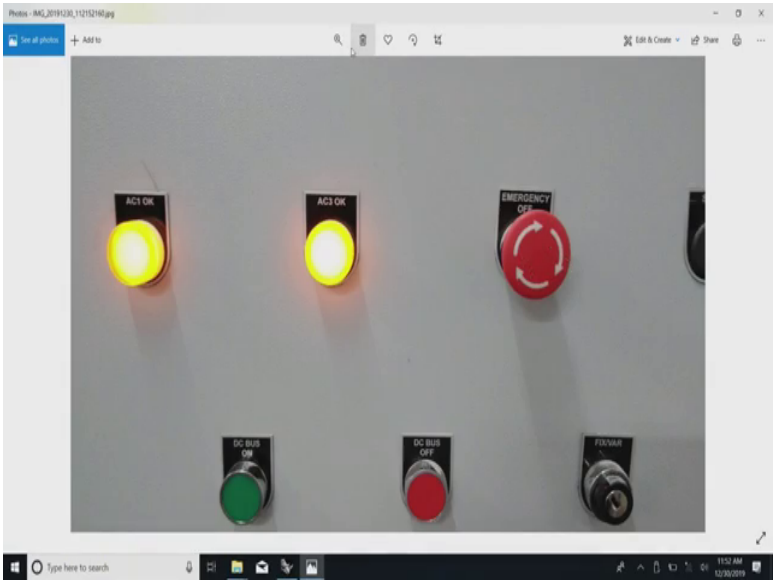

Now, something which is related to this, which will just above in another thing is this one, I am sure you have noticed what this is.

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These are almost obligatory, you understand this emergency off and these things are obligatory to prevent some of these things from miss operation sometimes a finger guard is provided there. That finger guard has been provided in all the other cases you have seen in all the other switches there is a round ring which will prevent somebody from accidentally touching it.

But if you see here intentionally any of these emergency stop devices project out of the panel. You understand we should never hide them behind a glass and writing there now saying break you know in case of emergency, break glass does not make a difference it needs to be sticking out like this.

Advantage of something sticking out is in the real emergencies somebody can just press it and if you see the large size also it is something about it and further if you press this now been it

stays pressed, you understand everything is isolated through a huge contactor everything switches off and it stays pressed, by itself now you cannot press it again and release it like that there they have given a another safety precaution saying if you now turn it anti clockwise. I am sorry let me put it another way it has locked itself in the anti clockwise position if you write it turn it clockwise it will pop out.

So, a person who has now attended to all that thing whatever the emergency, the emergency can be some miss operation emergency can actually be a fire or something. Finally when they ready to start they just need to twist it clockwise and it pops up and you are once again you start the sequence. What looks like a very simple and matter of aesthetics in this case functionality is very very critical you understand know which is very much related to the other ergonomic aspects of it.

It is not a simple aesthetics aspect the ergonomic and aesthetics combined in this case is we should be able to identify the parts very quickly and generally by default red always means stop and green means on and that thing about that 0 and I and all that has other this things. I just have taken you into an a extreme example of a industrial equipment which is there on our premises which say we are involved in it. So, I wanted to show you this. Now, let me get back to a very (Refer Time: 11:05) this thing.

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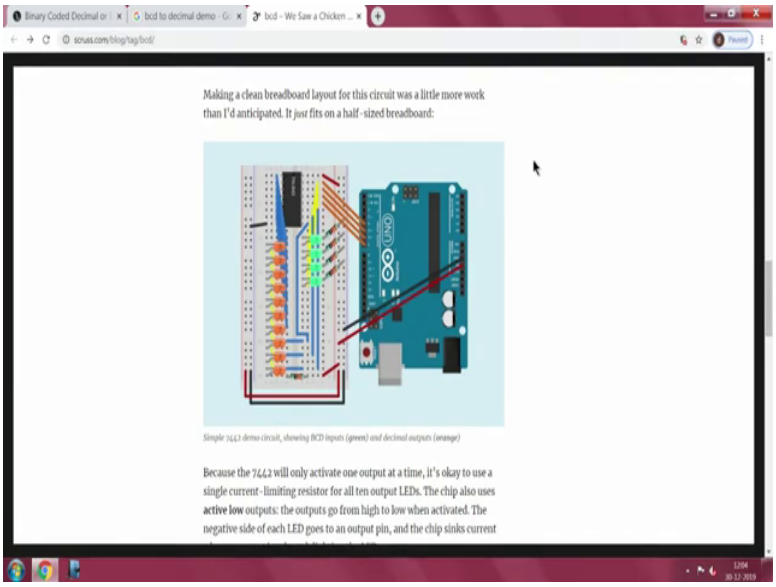

Please have a look at this monitor, we have stuff here about how a decimal versus BCD demonstrator can be done, as a circuit board it is fine it just work seems to be working very well.

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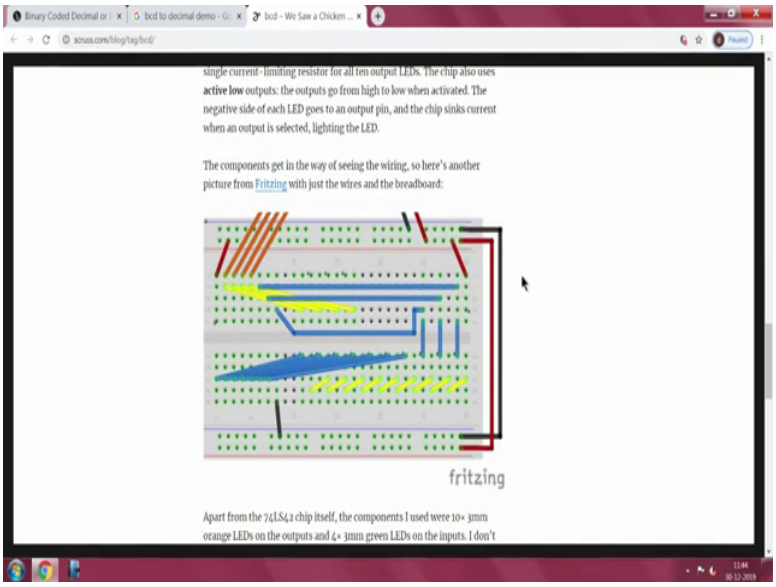

And you have the what you call jumpers everything and all that imagine and there is a beautiful code also, imagine you need to make a equipment out of it.

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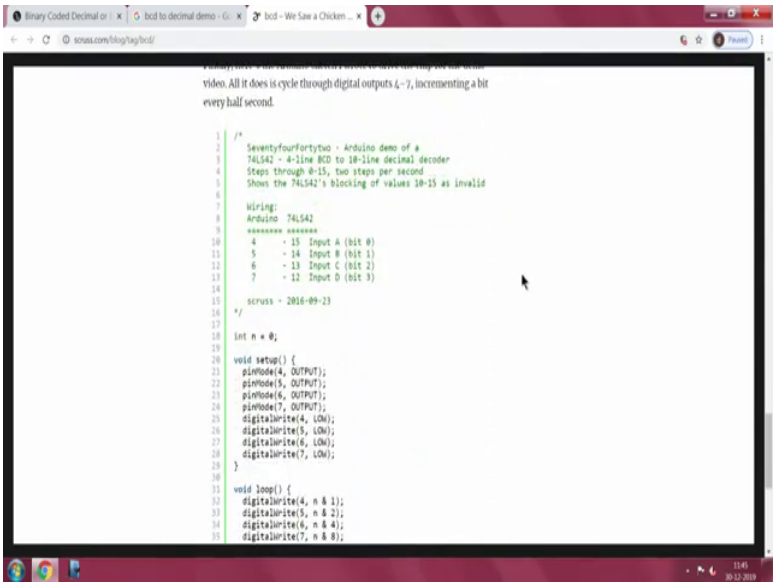

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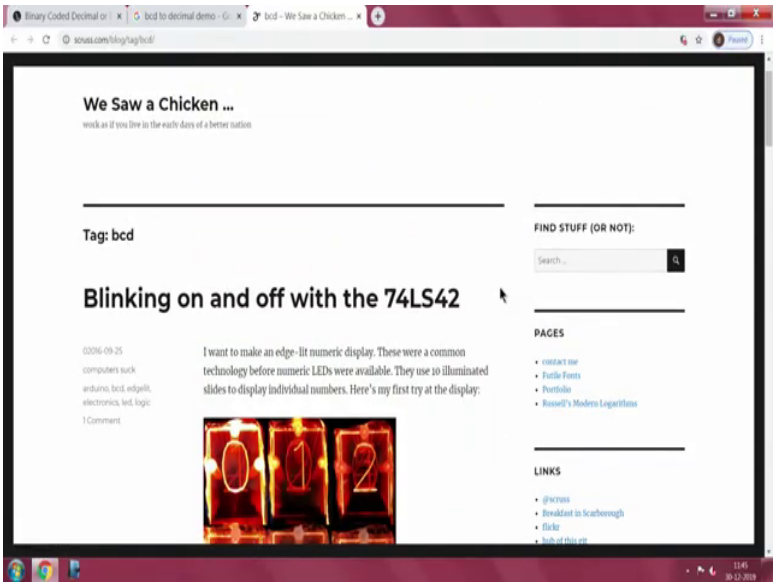

Now, comes the very very interesting problem you have seen this, why I have taken this particular thing is saying I will now try to create something on my monitor using one of this ah.

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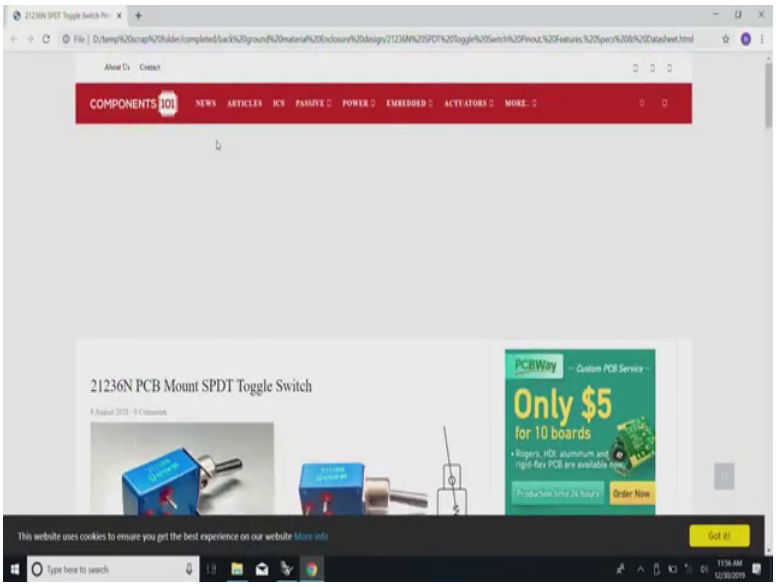

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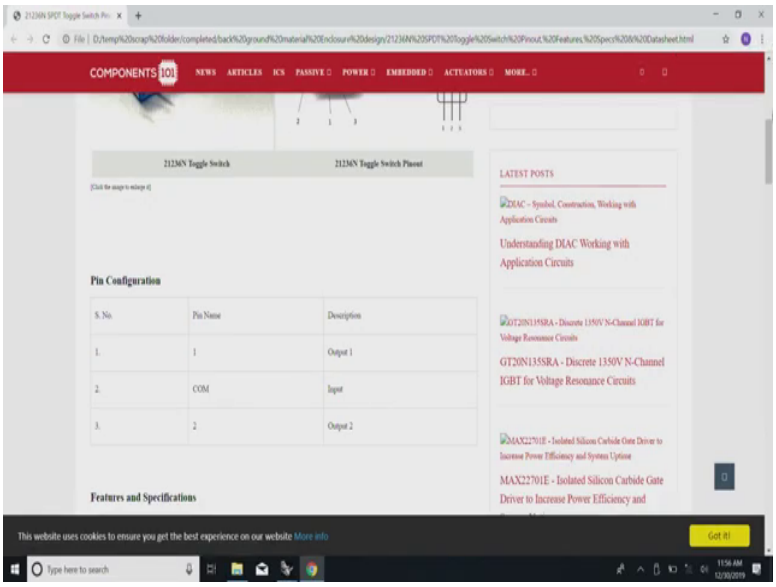

You remember this I have this toggle switch mounted on an edge and then I have a visible thing here and all that imagine.

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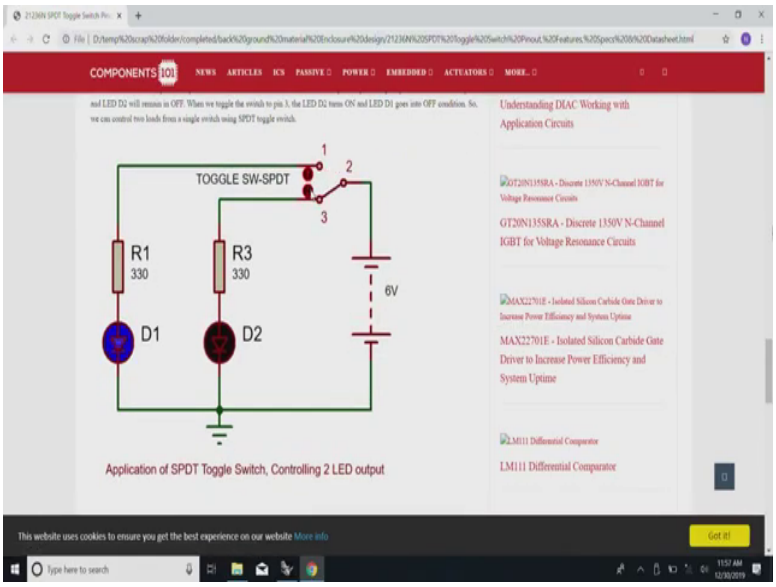

Now, I would like to make in this case only two are shown D 1 and D 2.

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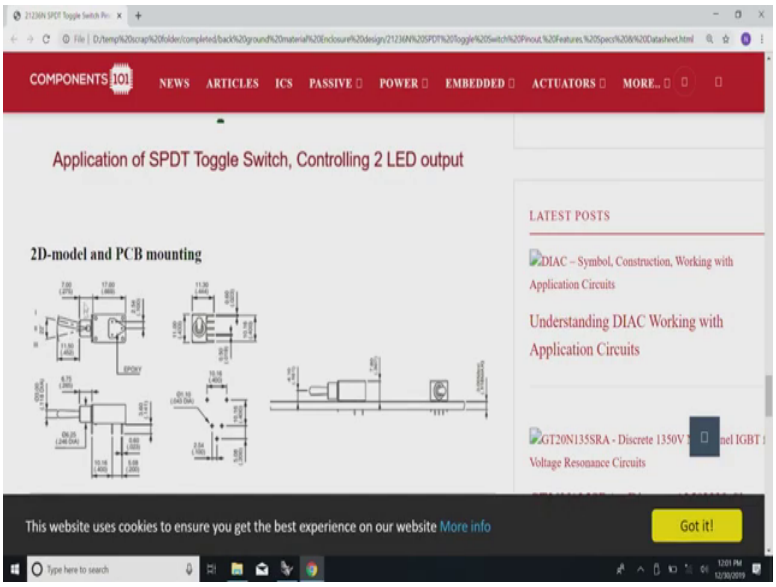

And I would like to make a regular equipment using all the data that is presented here, you have seen this is where my insistence that you will learn all about the what you call small the nitty gritty of.

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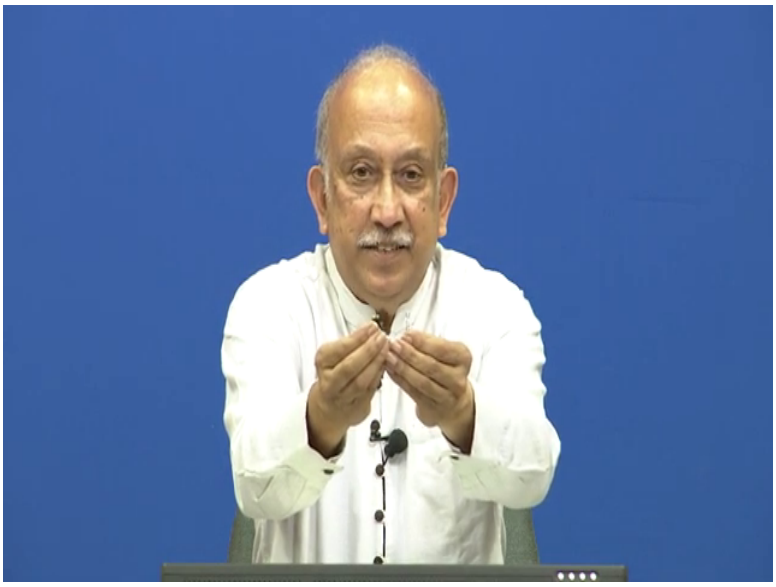

Please have a look at these two things sir show them there this one you see here a very two tiny LEDs one is a normal something which is a clear mould. So, you can touch and see a clear and another which has green and a I will call it amber LED the whole thing is in a pack. The thing here is you can see it goes in straight here, in this case you can probably put it in a printed circuit board it goes on the edge. Now, comes my this thing is I need to make a solid model for this representing a mounting position and opening for these two things.

In this case probably a small circular or something you have seen this here, I need to make a solid model based on, the way this is mounted at the bottom the mount of outline it occupies how much it projects out of the panel and if I make it now I can push it wherever I like on the front panel. And in the other case this one is a very general purpose clear LED in this case

traditional way of mounting it straight, but; however, it is possible for me to probably bend it like this and also make an arrangement like this.

And see how it comes out, very rarely directly is mounted like this usually it will have a small bezel one small bezel and nut will be there it is not it is very rarely it is directly pushed into a opening. So, in cases like this we need a have a solid model which has the bezel then the panel in which the opening is there then the device itself and once the bezel is mounted at the back we have a nut also for it.

So, the whole thing and the lid out both down and straight plus in case you want any place for a designation on the panel if these are different a place for it. Now, if I make this whole thing in a solid model it is easy for me I can go and fix it up and the magic is only I need to make it only once, I can change the color, I can change the designation, I can probably change the diameter and various other things.

And you would have now seen this for example, in all your cars and all that know very rarely you have that old lights, you probably have some device like this which has instead of it sticking out of a panel you have a small when I will sticker with a place it just I mean it lights up behind and sometimes what is called a light pipe also is used you can have them in various places and put them close together or far away from there.

With this, if you make this in a solid model and you scared you just need to you make it first time, once you make it everything works well got my point once you make this everything works well in there. Now, coming back to this you see here all the information I want about how to mount it is already given here including position in this case this is sideways seen this. So, have something which is left and right I may want something which is up and down.

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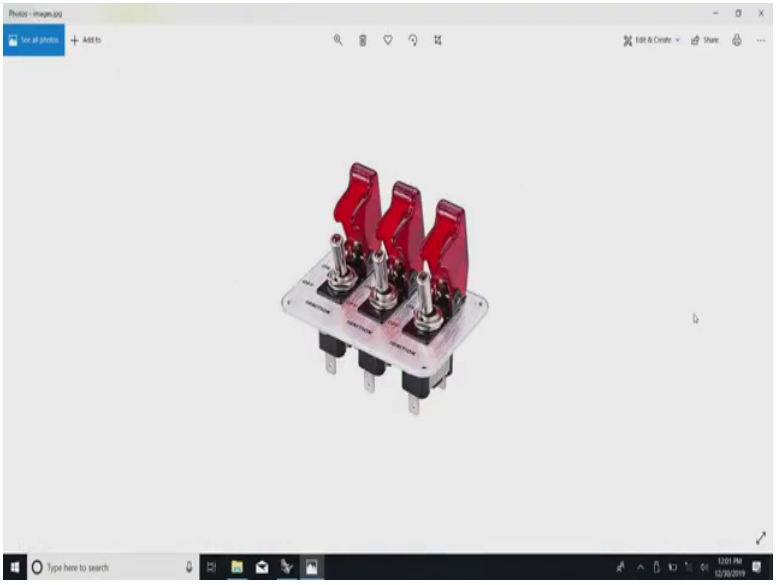

So, I search for a proper device which has the this where I left you last time, this is also part of that large panels which I am talking about, but for the while I will just quit I will come back to my starting of a CAD model.

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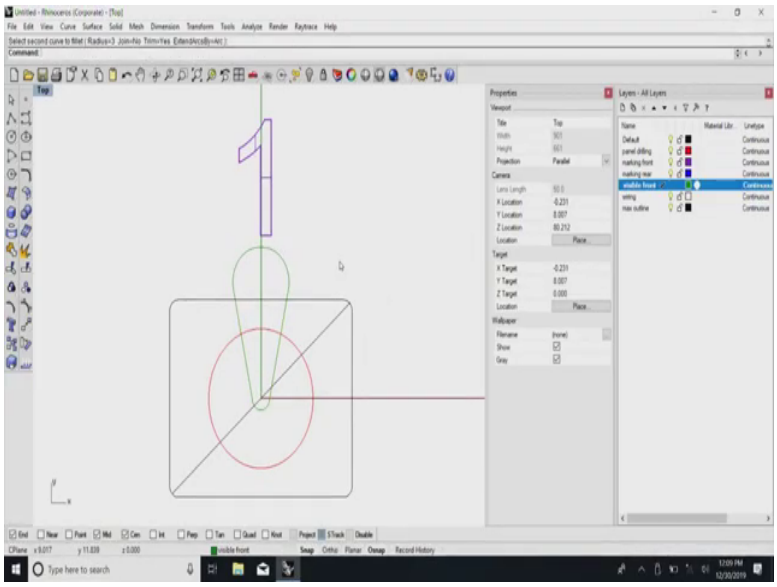

Intentionally I have taken probably the simplest possible thing, now come the most this is a generic way of dealing with a any of these 3D modulars. Usually there is a layers what you call a subset or a pull down you know drop down or you know pop up whole scheme in which this layers what I was talking to is about by default there usually be a default layer in which whatever you do it works easily. Then after that for convenience here they have just made it layer 1 2 3 and I can now designate any layer thing I want, one of the first thing I would like to probably insist on is make the panel drill.

So, I will now call this as a panel drill, you have seen this I have got a thing which is called a panel drilling thing. Next one I will call it I have made one more layer called marking read and then I will call this as visible front and last and most important is the wiring detail. So, I have already 5 layers marked which are useful for me, in this case separate colors are given. And one more important thing is what you need to do is the layer not these are not physically

one over the other, you understand all of them occupy the same space except that the tag associated with it is different.

So, selectively you can switch on or switch off things as you like, got my point the idea is they are not physically one over the other or anything that they are just a it is an associated label or tag that is associated with the particular object. So, it is possible for me create everything group them together and move it happily wherever I want and then whatever I want will come there. So, it may look primitive and redundant, but still just watch me do it ok.

I will start with a switch with the maximum outline. This maybe the outline of the whole device which under normal circumstances it does not interfere with each other, you understand this is the basic outline which I am going to keep it somewhere as a part of the layer. Now come, the other details here say this is not centered properly.

So, I make a line here, now it says in the coordinate center, you seen this is the whole outline. So, I will create one more layer here saying maximum outline or now this whole thing I am going to group it together and there is one more option for me where from the default layer now I can put it on the maximum outline layer.

See here everything sits nicely in this, there is no problem now at this point let me introduce a one more which I will call it as a panel drilling layout. So, I have here a maximum outline they have a panel drill which sits there and then I have got one more here saying marking front. So, on the top here one more I will see if I can see there this I can now change it as before to the front marking then I come to visible front.

In this case I need to make a slightly complicated thing but just for our what you call starting allow me to me this looks a little like a toggle switch in the up position. Now, you see here I have got a toggle switch which for most practical purposes ideal for me to use it wherever I like, now I will see if I can do something about it and arrange a few of them on a on a panel.

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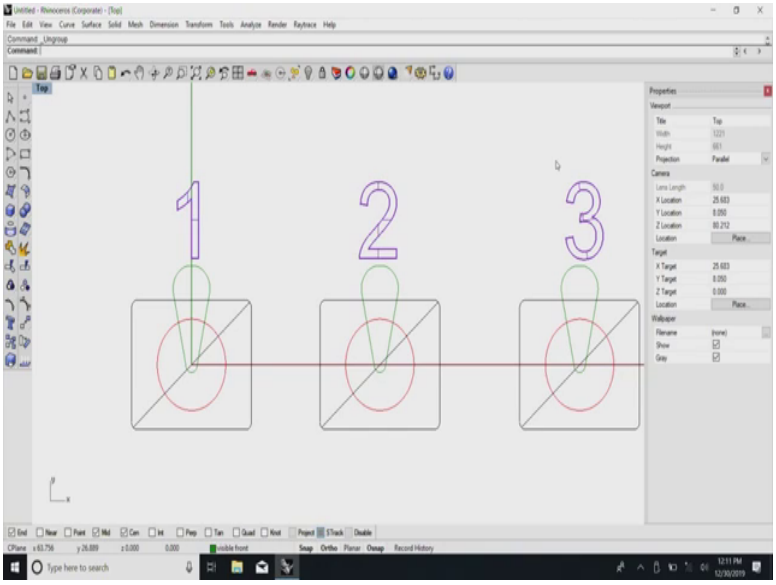

Now, if I group all of these things together and see I have a panel in which 3 of these details are there. Now comes the interesting part of it saying if I want I can probably edit this and introduce a different these two have been wrongly associated with a different layer it comes to yeah this is visible front I am sorry.

This is the wrongly associated now I need to change this to, see here there are 3 bits of details. Now one of the first thing I will just wanted to show you in case you now want to take a printout of only the panel drilling and make dimensions you can always go back here and take only panel drilling.

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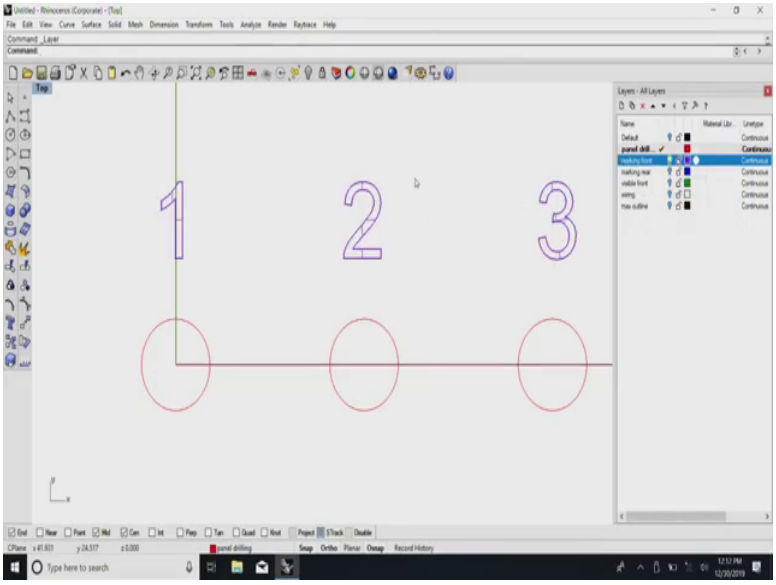

And you see I have a beautiful panel drawing here all the openings have been given here and following that convention about dimensioning I need to make either a baseline dimensioning starting from the left or successive dimensioning or if they are groups let us say 2 of them are a group and all that I can use the panel drilling detail and move it around wherever I want.

You got the point and if you notice they are not physically separate or anything they are just designations which are on the other thing. Now, let me go back to this front panel marking I will now switch on the front panel marking, eventually we will have the openings and we have the front panel marking. This is all that is required for you to make the layout of it, if you want you can probably that visible point if is there know that thing you can switch it on or switch it off and you can make a very complicated panel by arranging all these things.

And most important is what I have showed you earlier is if you see the drilling detail in this case I have avoided a drilling detail point of it, it is possible for me to make an orthogonal view.

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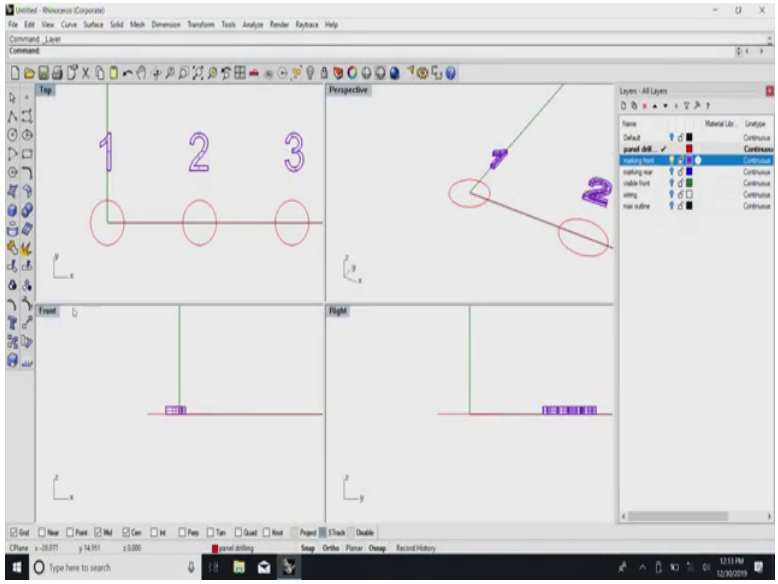

In another view I can come here you see here this is the one view and the other view I can now give all the drilling details and all which can directly sit on top of a panel and it can be again 2 3 types. In case you are having a printed wiring board directly the footprint can be used in the printed wiring board and me being a product designer and vertical enclosure designer.

Somehow I feel immediately after this your first level of bread boarding is over and you need to at this stage find out how to make a proper enclosure for it and in the enclosure design we need to decide on how to place all the LEDs and all that so, that intuitively we know how

these things work. It is just a demonstration project in this case if you see they have given a board saying how to what you call as he says one input at a time and I mean a lot of this keyboard parsing and all this stuff is there.

It is very much possible for you to try it and in case you have mastered the art of these things. In fact, there are programs which will allow you to do without physically having to show anything here. In that case I just need my 3D solid model I need a simulator in which I can put all the circuits wherever I want put it inside and full at least digital simulation can easily be done. And after the digital simulation is done it is very easy for you to fabricate a printed circuit board based on all the detailing which we have given and also make a clean front panel layout.

So, in this case randomly I have marked 1 2 3. It could mean 1 2 4 8 16. So, very easy for me to make some device I have a display on top which shows the decimal number and I have this case in which I can operate so that you can demonstrate it. And in this case the focus is on the using the what you call any of these ships since Arduino is very popular I have picked an Arduino any of them we (Refer Time: 26:46) whether we can have raspberry pi or you can have anything you want with it and probably you can have wireless also, all you have to do is somebody place with this and then you see how well the numbers change.

And if you are quite happy with it you have an equipment which has been done without actually having to probably physically drill holes are put anything and then you just move around all these components and you have a fantastic ready to fabricate front panel drawing and you can even have a vinyl sticker which can be stuck on the front panel and everything sits neatly. And you also have a visible front which is there and this front can be used in the training manual.

Imagine you are trying to teach it to a first time or you can tell them, you see we have all these keys and just I mean what you call play with the keys and this is the number you get. And printing a user manual is very easy because all the information is already there, not long ago

maybe around 20 - 30 years back every time somebody had to do all this and otherwise you have to use two different programs.

One is a illustrator program where you write all this and try to copy all this otherwise and you had to had a separate what you call this thing like CAD program in which you know all the openings dimensioning and all is shown. And yet one more where the visualization is done which even today is probably done very much in the building industry, because the complexity and the variability so on and then there is no one person who can handle all the things.

In our case fortunately if you have a just the information and a will to make all that one time you need to make this, make a component preferable a 3D solid model and in this case for convenience I have just shown it to you as a 2D version. I can make it in 3D means I will show you a nut, I will show you bezel, I will show everything and move it around wherever I like.

And let us say I need that LED on top of it I can group these things also and make it into one part. So, when I move it around I can see that the LED also moves with it, designation also moves with it. So, coming back to that old you remember that control panel huge one which I have shown you we can really populate it we can group it and what was simple ergonomics and functionality now a little bit of aesthetics also we can build into that now because colors there are not used for aesthetics.

So, I will continue it later I will stop it here. So, thank you, this time I will prepare a good model and just show you how to just put them all in one place and then how to put them all together.

Thank you.