Electronics Equipment Integration and Prototype Building
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Lecture – 32
Illustrative simple design

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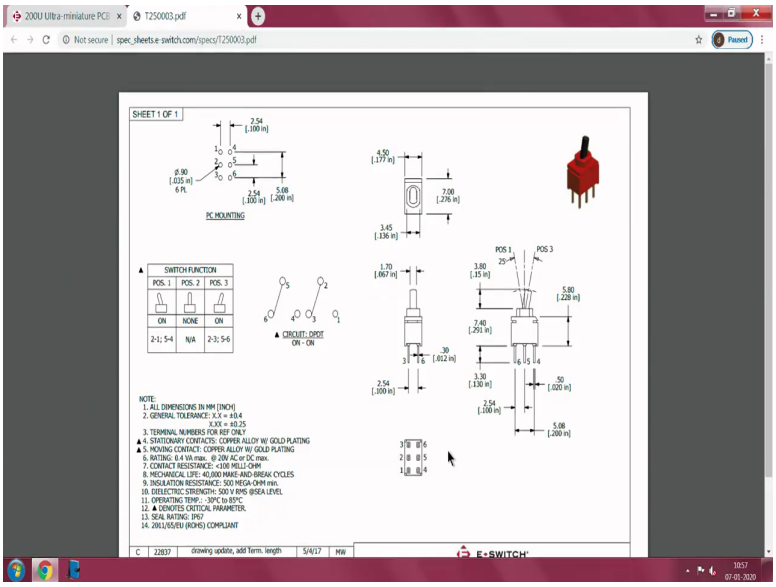

Let me continue where I had left off earlier. So, you please have a look at this monitor. This is a switch here has all the necessary details in their data sheet except that it is in 2D flat. Now, this whole series and this what do you call module was related to how do you make computer assisted design and layout of equipment. And, one of the starting point is to make the simplest thing is probably to convert all these to a digital form. In this case what was happened is they have just made it into a pdf, but it is not a full-fledged usable directly usable 3D and solid model.

In the case of the solid model, well the appearance is here, you can see that there is a will the appearance part of it is a little useful in real a simple pictorial or rendered image is not that useful for us. Even if you would like to download the CAD models when you download the CAD model only the model will come very rarely something related to the pitch these dimensions this thing are very rarely part of the any solid model which is provided by the manufacturer because this is something the designer has to work on and make things.

Now, if you see this I have taken this small portion at the bottom included it in one of the layers of the drawing which I was telling you about, followed know? I was trying to show you one of the layers in which include this. This layer this particular layer which is at the back this is actually looks like the rare view of it meaning you look from here and then you can see these are four standoff points.

And, something which is very very interesting and very important for us is that if you have a small switch and if you mount it somewhere the amount of projection which it provides. This has to be perfect almost to the extent of saying it should be if your panel is far away from this projection, the switch will not be accessible if it is interfering with it then the whole system will collapse.

So, within a reasonable thing so, here if you see here they have given saying you see this is very critical you know saying from this mounting point here at this point 5.8 inches has been given similarly how much it projects at the top and horizontal stacking, see here the if I search somewhere I will get the necessary dimension correct here you see they have given saying 4.5 millimeters. So, logically it means if you place this, these points as per the 0.1 or in this case know you seen this is 0.1 inches is there. Next 0.1 if you place the switches also can be stacked together.

I feel it is a very convenient way of doing it and this is where making your own library of these components helps it may look a little repetitive and all this, but I think when you actually try to make this things you will understand. Now, I have a cute small very tiny switch

in fact, it is called miniature I can stack them as I want and to enable that switch to be stacked and all that you need to make a proper solid model.

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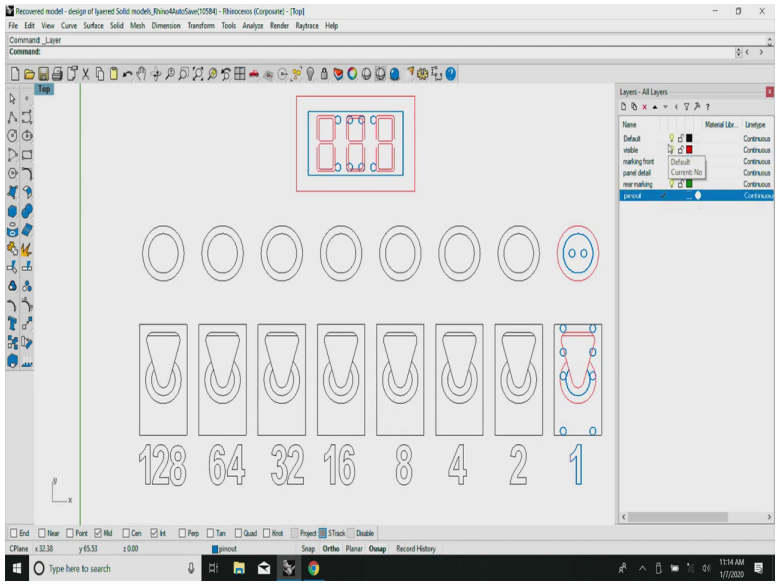

Now, please look at my other monitor where I have tried to make these things here. This is something which has been made with other components also. I have arranged for 8 of this switches here and to show what is the amount of detailing that is necessary randomly I have picked up a very small equipment which I showed you earlier if you remember saying can we make a demonstrator saying how binary if you operate the binary code how do the what do you call the total value change. In this case I have an 8 bit code and then 255 actually 256 states if you start with the 0 state also total 256 are possible. So, it ends of with that 3 digit display.

So, if you go to the component suppliers and all that occasionally all this data is given, but with the same thing as I have talked about with the switch. Useful data is given, but you need to convert it into a proper solid model which is useful for you. So, I thought I will start with this you see here at the extreme right.

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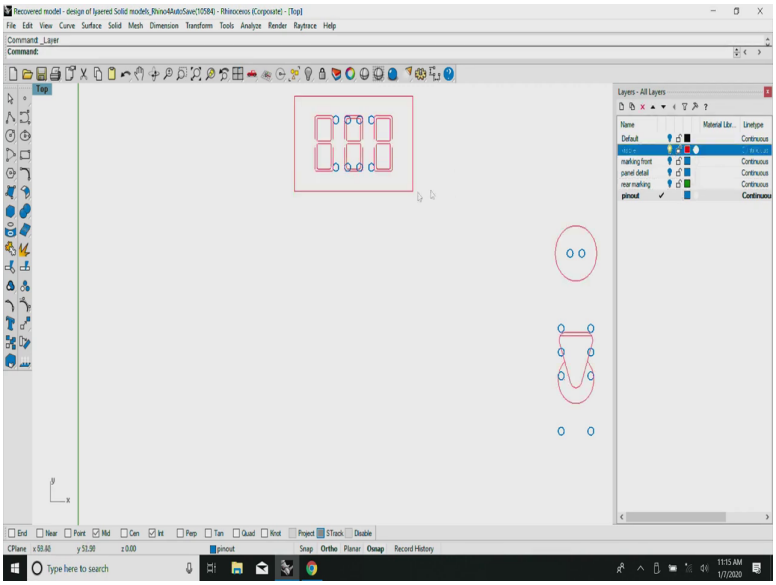

Now, let us say I need to make printed circuit board. So, what I do is. So, if I removed everything say what is happened that part which I needed for the display is very much here. So, if I switch it on what is visible on the front panel is here.

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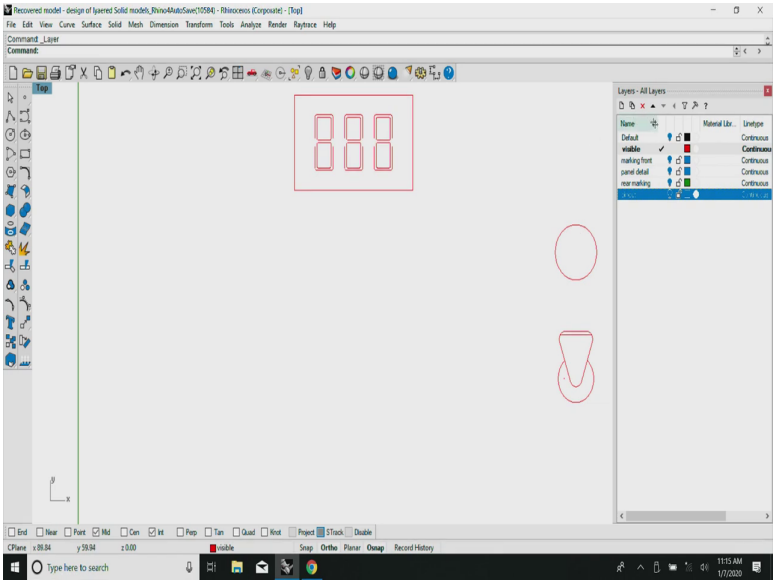

Similarly, in this case I have this. So, if I had to switch on and switch off the other thing, eventually my panel detailing will show all this. I have 3 digit 7 segment display there, then I have this one switch for our convenience I have just placed it here now. I will say what best I can do with all this I will switch on everything and for the while just remove all this stuff.

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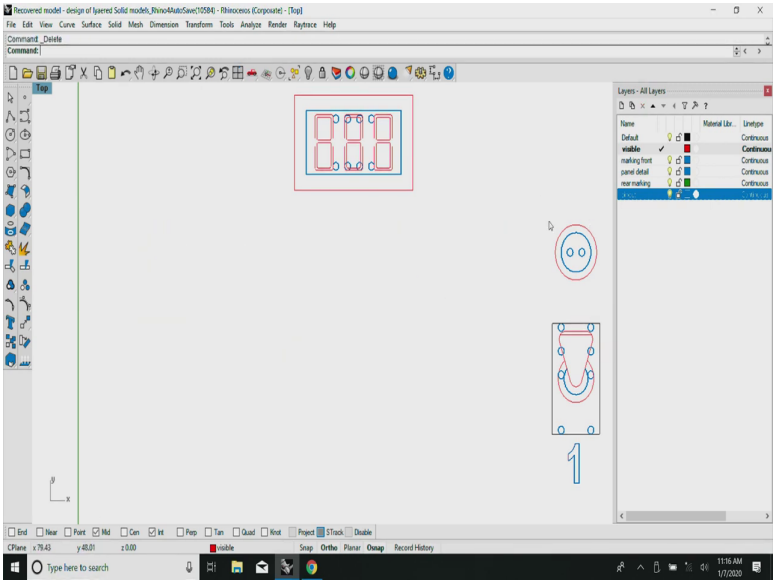

Now, see in this here I have started with a clean slate. All these things have been grouped together. So, we can move it here and then do whatever I want to with it. Intentionally I have left one character here I can play around with it now.

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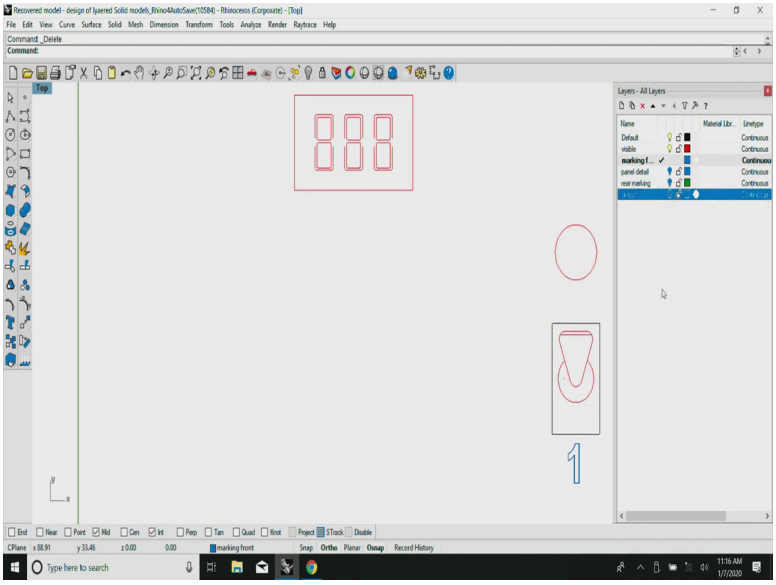

So, in the visible or this what do you call front marking see this much is quite there. So, this blue part represents the marking.

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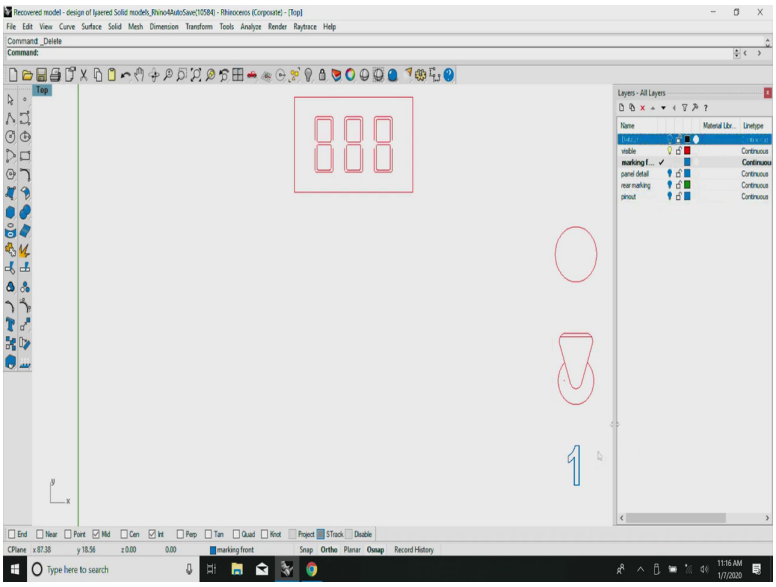

So, actually on the front panel I can now make a if I want I can group it just like that I have shown this visible portion, if I want I can remove it and get the marking that is required here. In this case this one is shown here, but then you see all of them have been tied together.

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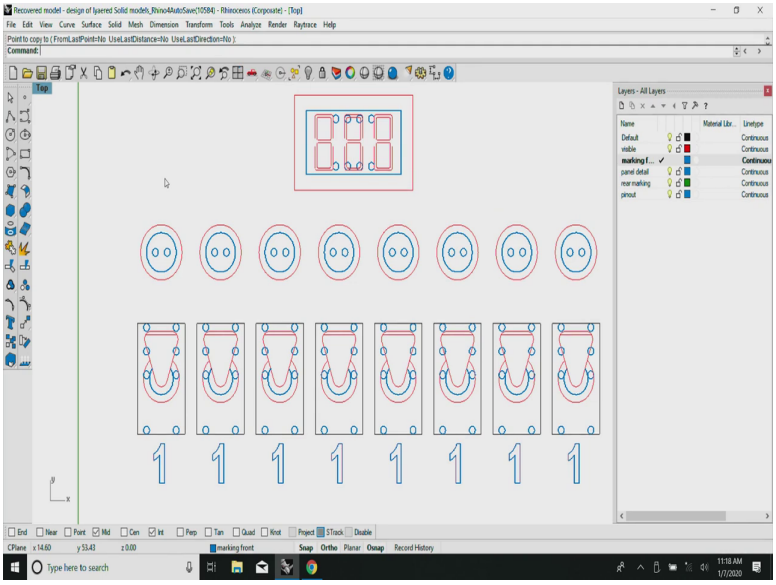

Now, to go back to the point which I am trying to make I will switch on all these items see this and copy them in a pitch 4, 5 instances, 6 instances. Now, I have 7 instances total 4 plus 7 plus 1, 8 instances are over. Now, you see here happily I have I just made one component. In this case just for your reference I have included the text here.

I can in fact, remove the text and having seen this positions now I can put any text I like on top of it you have seen that. So, and instantly these are also the what you see here are the confirmation LED on top and the these are the leads of the LED. It is very convenient for us just to take the LED and bend the leads down, understand know? The leads will be sticking out like this. If it is horizontal it is easy to bend if they keep it vertical it will be difficult to bend it over and perhaps you have know tested this is best if there is a flat PCB directly behind the front panel.

And, here comes a very important thing here randomly I have just moved it by steps of millimeter. So, nearest round I get is the 5 millimeter otherwise I have used the 2 millimeter, but if I am to use the grid which is available on the visual printed wiring board it is imperative that I follow the 2.54 or 0.1 inch grid in that case without any problem these things will perfectly fit.

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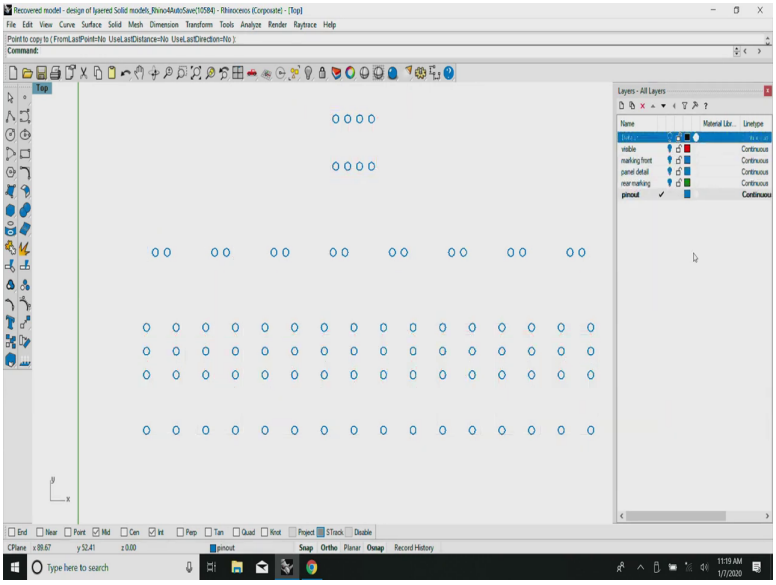

Now, having done this say if I want to do only the printed circuit drawing all the detailing is available except in this case I wanted to tell you that intentionally I have just used a convenient millimeter grid of 1 millimeter and then placed it at steps of it. Now, everything looks quite what you call smooth and uniform it is easy for me to mount things here and then it is easy for me to mount there other thing there and if you see I have not compromised on the actual you have seen this I have not compromised on the actual appearance of the unit.

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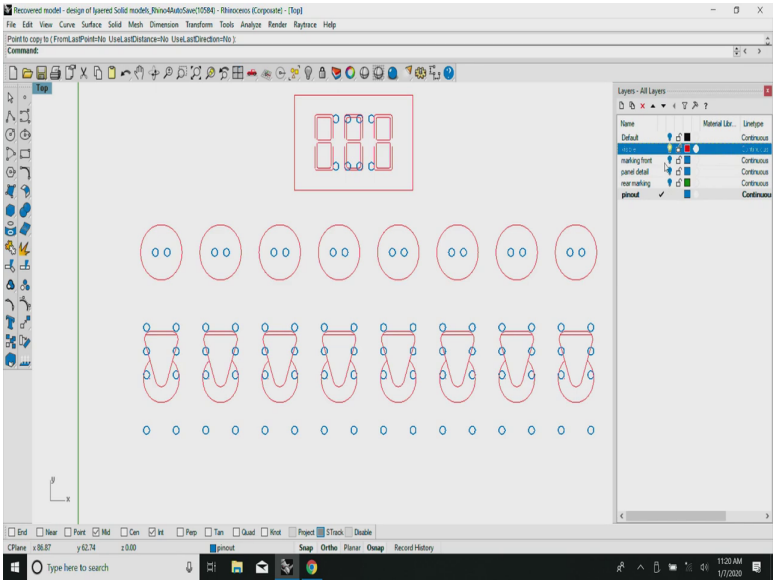

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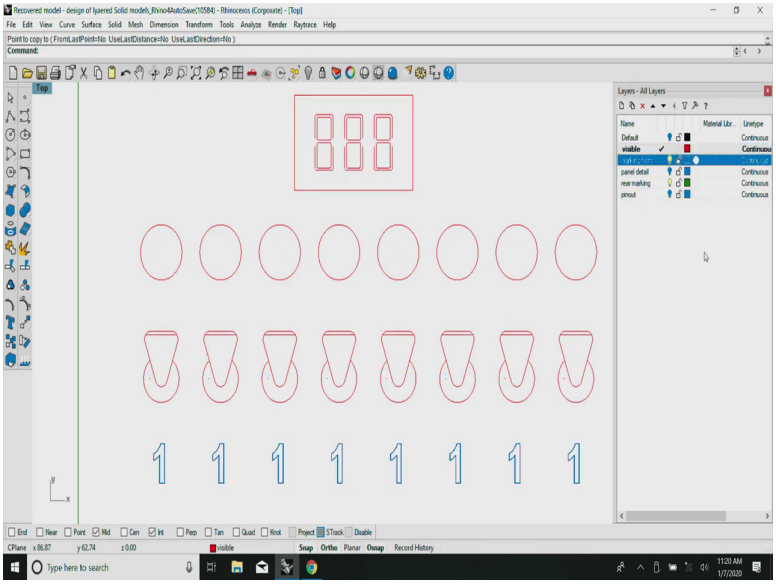

Now, this is where I know you will say know small with an apology and all that because of the in the rush of things. We need not actually use this text as part of the thing, you can just instead put a text marker easiest thing for us to put a text marker is probably a box or a dot. And, you can selectively switch off the dot and then once your design is over you can do whatever you want out of convenience I have placed this things here. Movement all of these are available for us here, now arranging these things are easy.

In this case, in this case you have seen that I have use the very simplest thing a small display and then I have used the equally simple thing like a round circular LED which can you can directly stick in the front panel; means you make an opening and put it or in this case a marker in circle is shown saying probably it is an opening you have put it inside. And, this is where you can enhance it saying instead of this the whole top thing can be a simple vinyl

which has a backlighting similar to what I had showed you earlier. If I have the vinyl backlighting all of them will come properly.

Now, when I do this vinyl backlighting it is possible for me to add for example, 2 to the power of whatever it is this one the first column is 0 after that you have 1 2 3 and so on up to 2 to the power of 7 which will come to that 128. Now, if you just switch this things up and down you have your beautiful equipment ready, you have seen this?.

So, if I want now try to add things like for example, it is a traditionally this is called the most significant bit or the digit or the position and while these things are for you to explain to children and explain to first time people you can enhance this product as you like just by adding the few graphics.

And, now this whole thing in this case probably whole thing can be run and now that things have become very very popular, probably you can have a 5 volts USB style some small you know power supply. You plug into any USB thing and all these things can be activated including in case you have in a place for Arduino chip or simple wiring these things. So, my concentration in this case is only about how to make the how why there is a need to make these things. And, successive levels of grouping and how do you manage these things.

In this case I have taken I say said no very very simple what do you call the simplest possible toggle switch. Now, if I can go back to these manufacturers every item. So, you have groups of control items include circular rotational things and the other things. So, if you remember if I will see if I can just remember all that large number of front panels and all I had made.

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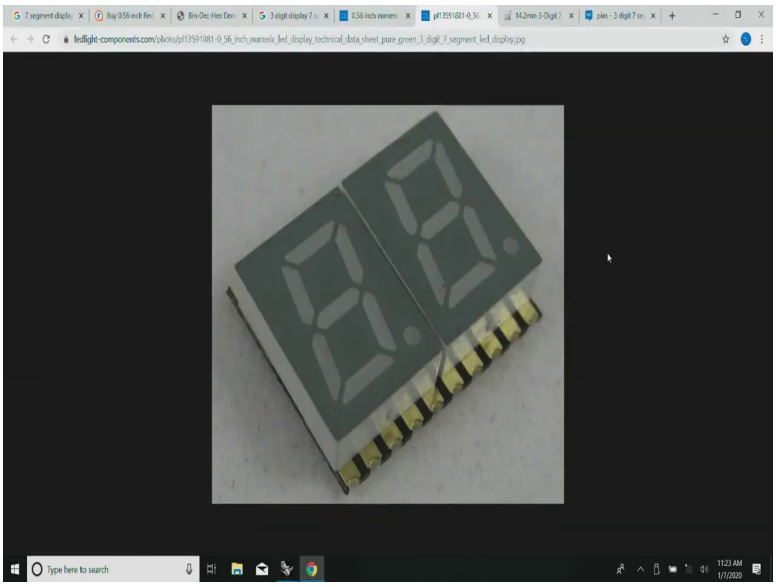

Now, you come to the other thing how do we run those what do you call the display? Now, if you see here some of the displays already have the necessary pin outs printed on this.

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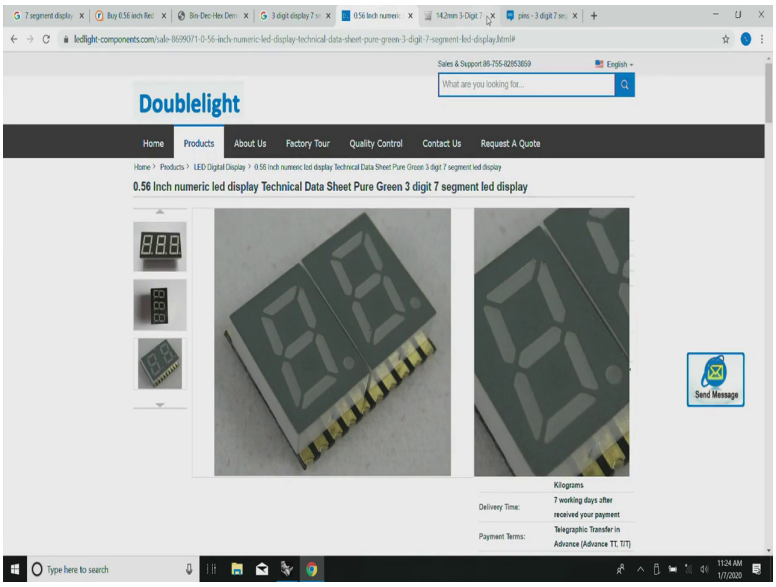

So, all these modules you need to just make whatever you feel like you have seen this?

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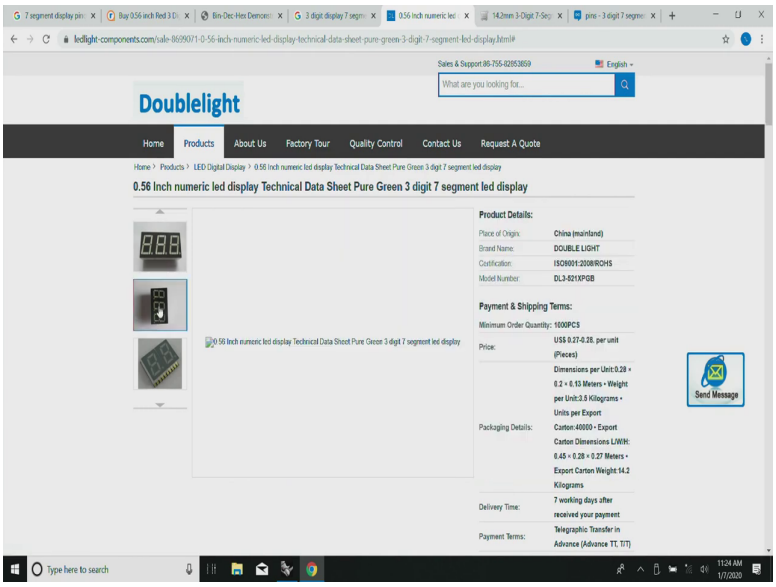

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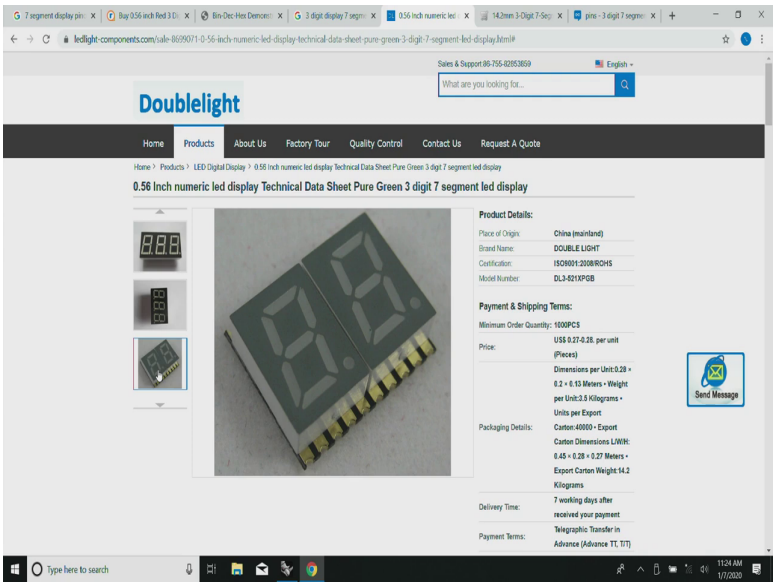

I have something here, I have something here. So, it is a matter of very very conveniently we can place all these things as we like, but they core concept here is that you need to make these 3D drawings not in a very conventional way. Now, please have a look at this here.

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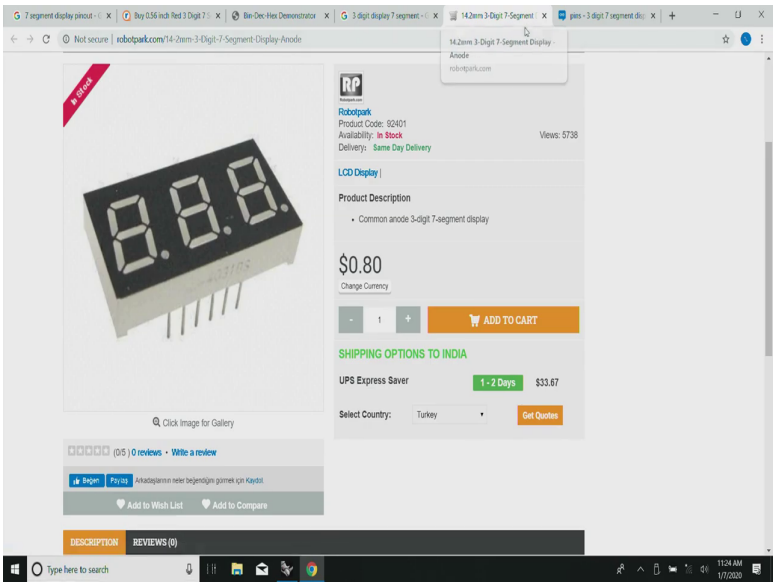

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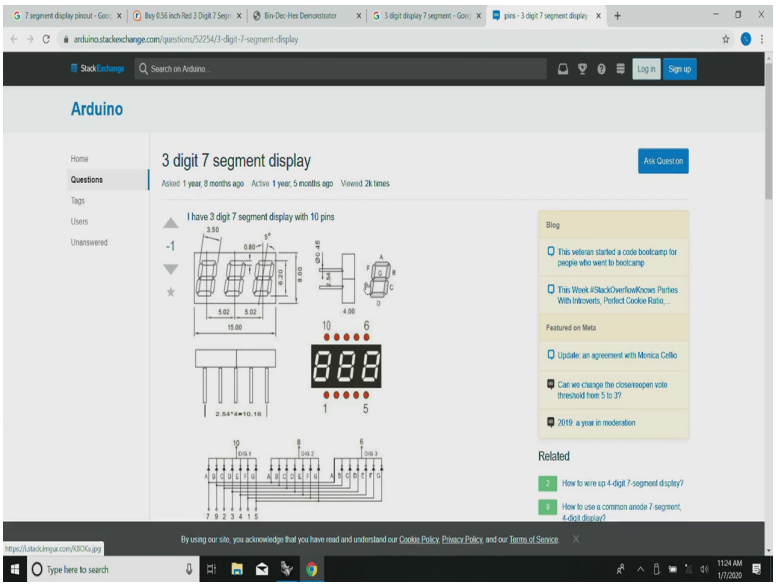

If you see here one of the thing will notice here is I have the three segments then all the necessary dimensions are given. So, this is what I was trying to show you all the while. So, these are not LEDs this is their conventional way of representing it; however, the earlier parlance what is called the table know is shown here saying in case you how this is what do you call digits are wired up how do you need to connect them and usually a 7 segment display drivers are available.

And, either you can use the 7 segment display driver or if you are familiar with any other technique you can make use of it. Now, you will see here the pitch about the between these two is they 0.1 inches. So, in this similarly the pitch also is here is that 0.1 inches. And, if you see total weight they made it 15 millimeters typically it will be that multiple of 6 grids.

So, of it is little less on that multiple of the 6 grids there it possible for you to happily stack them. So, life is very easy. All you need to do is the standard display is what you have that is a single segment and usually 3 and then there is something called 3 and half layer, 1 also is shown which is used for power applications. So, extreme left is only a single that is two diodes will be there without decimal point which are used.

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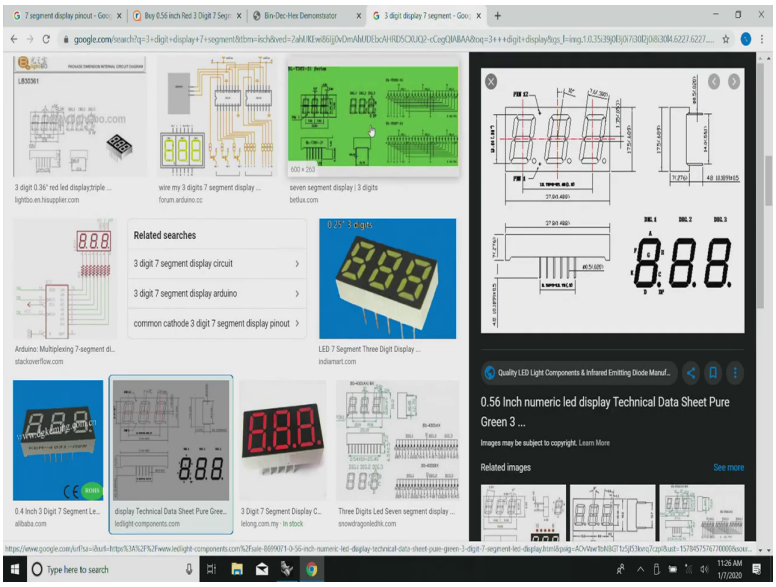

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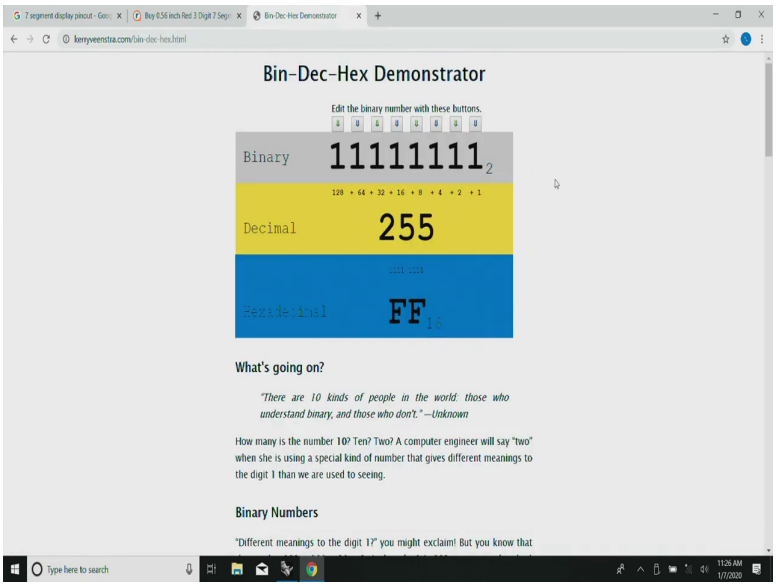

So, we just need to somebody needs to just go and search and anything you want most of the information is directly available to us directly. And, I do not know if I have shown you earlier, but I like to one more time know get back to this and show you.

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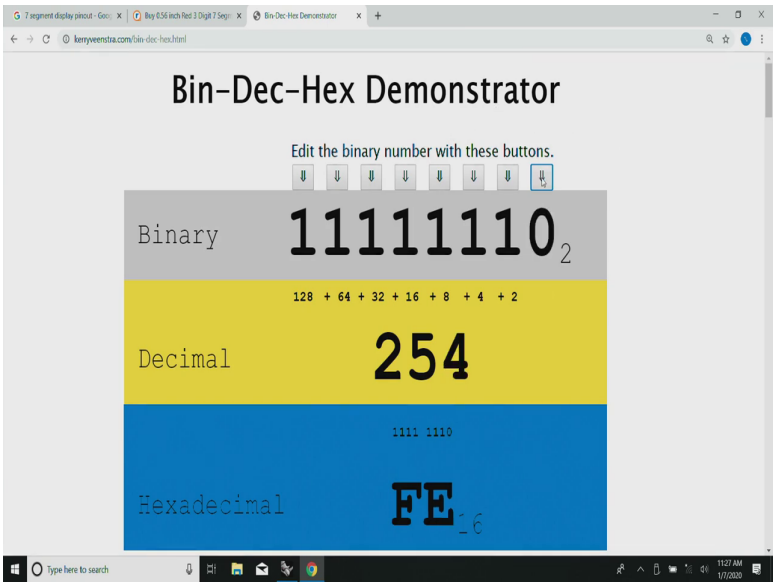

This is a just some routine they have made while it is to for us to show it saying how these things happen and so on here. What I wanted to show is why I have selected a 3D segment display is I need to have a maximum of 3 digits to be displayed here and the other thing also is about this know saying you see here I have a 128 here at the extreme left which is the most significant and extreme right is the least significant. It is a matter of convention other way also is there.

And, one which is not that frequently used, but part of the old microcomputer kits was the 16 position keys. So, I have a 4 by 4 matrix and that naturally leads to this hexadecimal it is common. So, instead of directly marking this 128 and all that I can put 2 to the power of also can be shown here.

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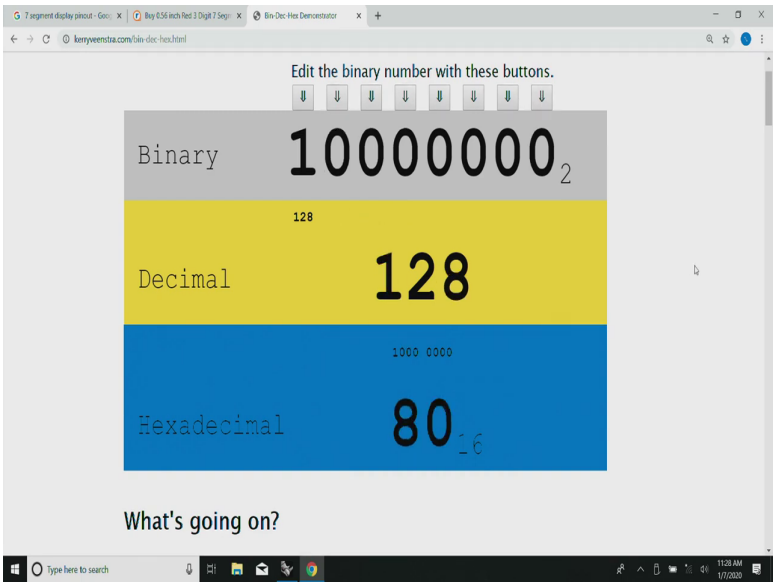

Now, so, if somebody wants to just check I will switch off all these things if I just switch the on you can see that I get 128.

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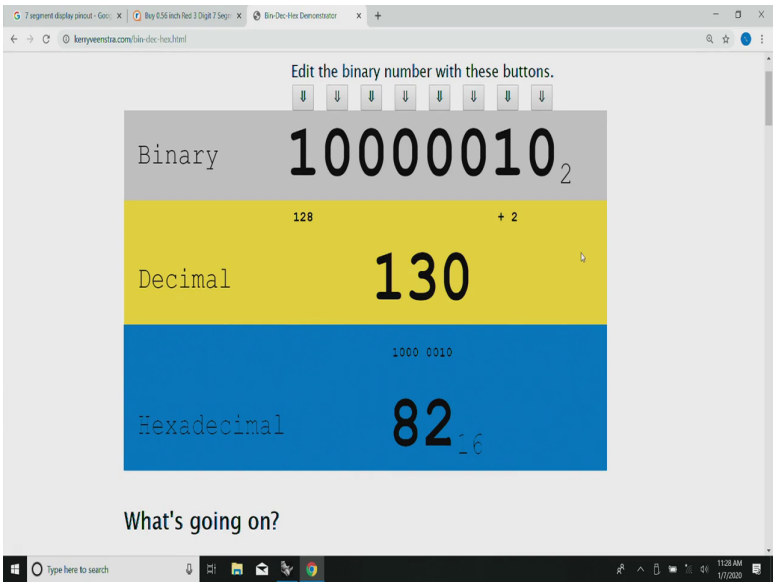

And, if the second position from the right I switch on I get 130 this is very very I mean it is the way of playful or joyful way of playing with things which we like. So, let us you want instead to demonstrate 200 unit. So, one is go by a trial and error otherwise you can make a truth table right from top to bottom and which one do, there are formal methods of given a number how do you find out which is it they you can look it up. One of the simpler one is take the largest thing first. So, I can remove 128.

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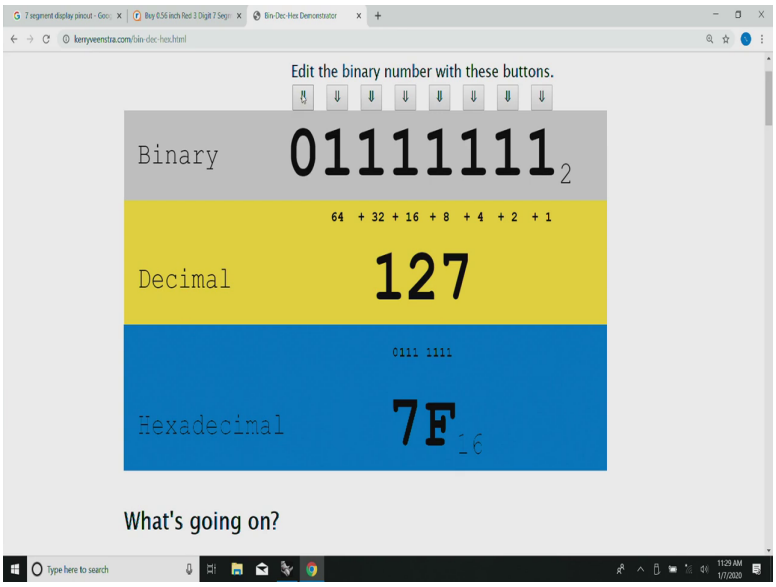

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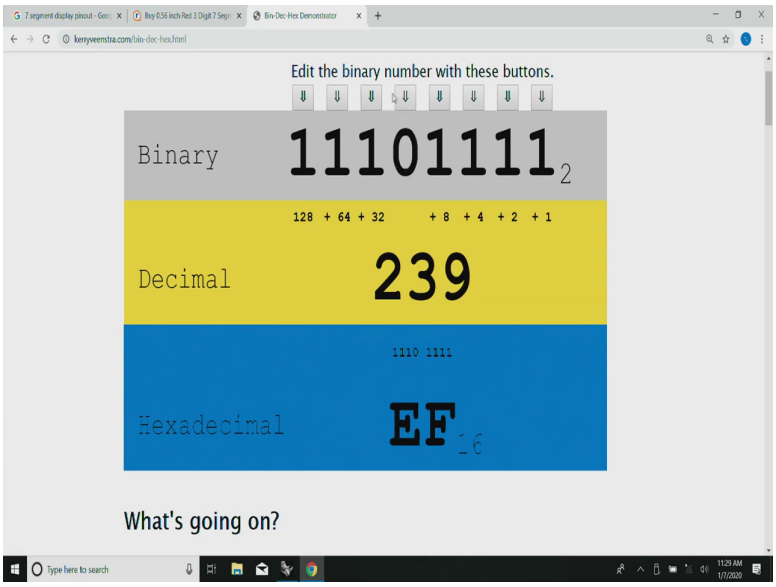

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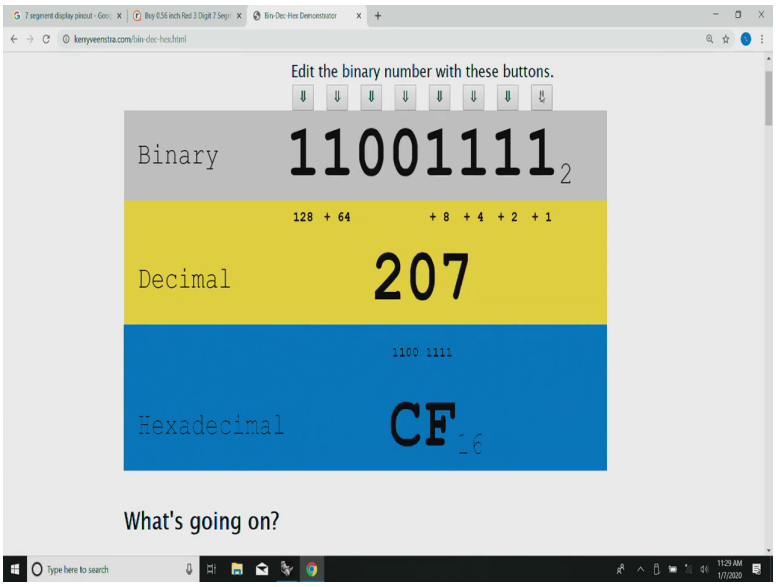

So, if you remove 128 you know how things will happen. So, if you keep on moving about it know, the number what you want will come automatically right now what I will do is I will just switch on anything just for you to right now that number shows 250 255.

So, if I remove 128 you can see how much it has come. It is possible for me now to go around playing with these things. I just need to remove that 7. So, how do I remove that 7? So, I have 4 2 6 1 I have got 200 if that is what I wanted to set.

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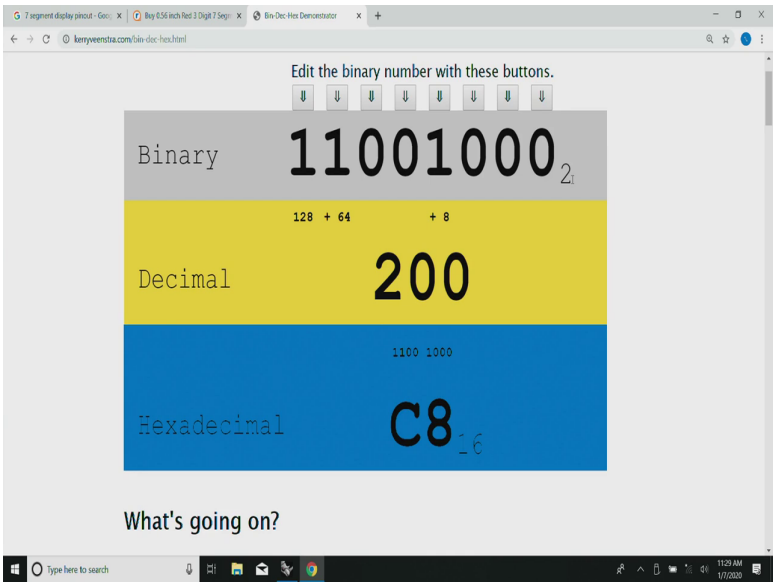

Now, you see here I can make somebody appreciate what is least decimal and all them because this is one of the very very simple and simplest way of making these things. So, which in a way I am very what do you call thrilled at it.

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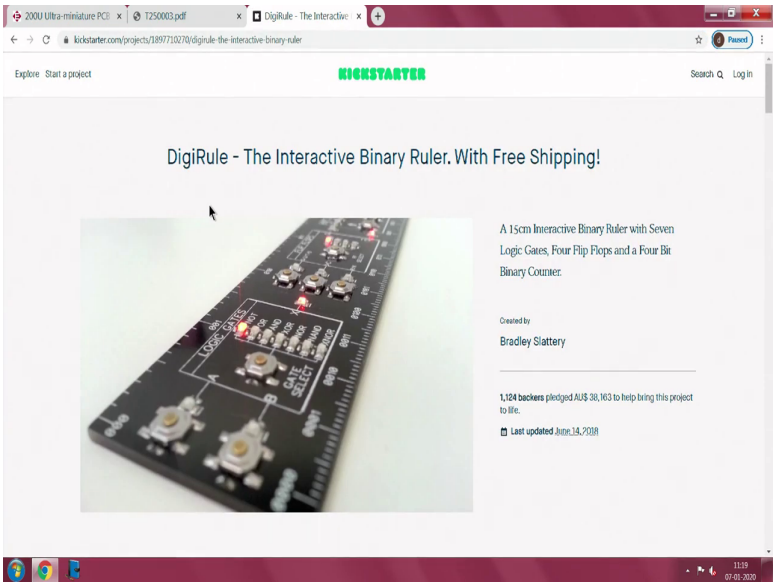

Now, if you have a look at this here this is a very just an interesting link. Somebody like you and me in fact, have come out with interactive binary ruler with 7 logic gates 4 flip flops and so on.

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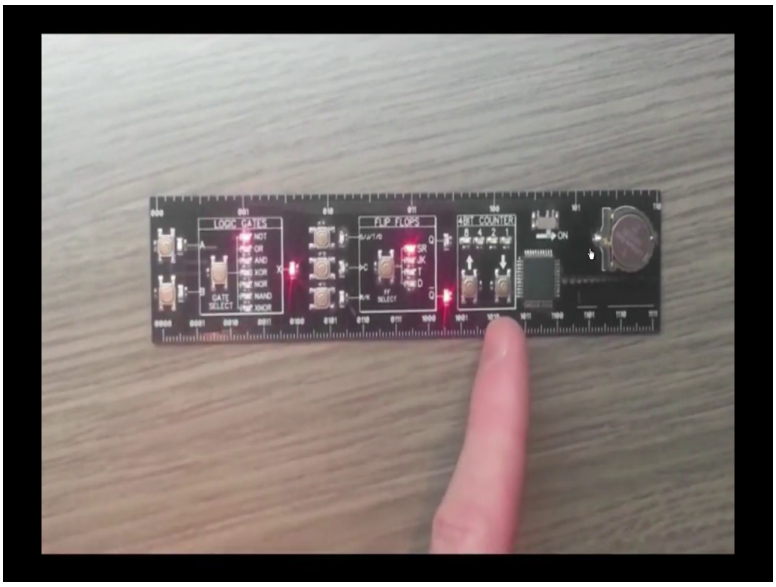

So, that children can play I mean can play around and learn things the way we want you see here. Somebody like you and me has made this common thing. Here intentionally they have marked things they have marked the gates, the style of gate you want you use. Then they have marked then there is a power supply there they have made a very simple interesting thing while outside it, it look simple actually it has a solid processor and it is all these other things for you to learn yourself.

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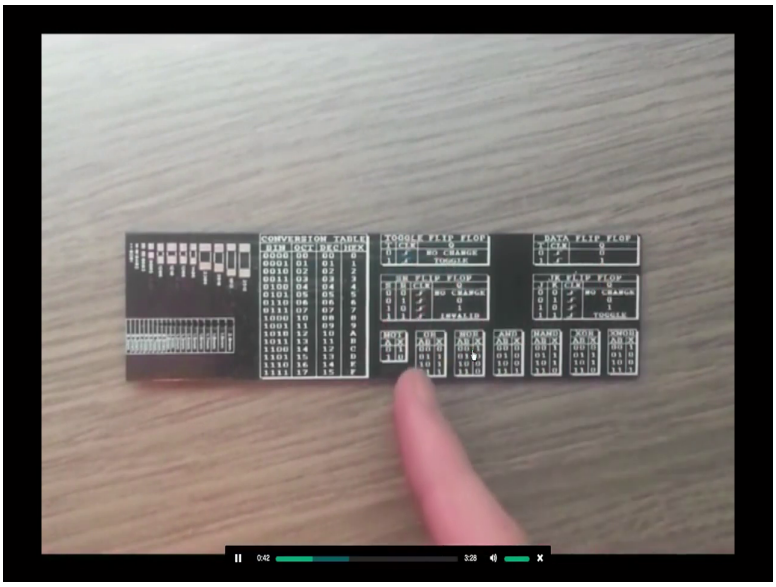

So, I was aiming it I think like this which are probably small devices which somebody can start with and in that case that one is say actually a printed wiring board with all the various you know functions everything built inside. And, this processor seems to be handling everything and it will show you the necessary what do you call end result. You have a counter and this how people can learn. Only thing here is probably there is no display because this is only a basic learning tool basic learning tool for you, so that you can one can easily appreciate how these things are going on and how do you fabricate it.

Now, you will see this one has been made directly on a printed wiring board with the pitch and all that which we are able to manipulate. Now, you can probably scale it up to a larger unit and in this case one thing what you will notice is this you have seen this how well they have grouped those things they have put all the flip flops here they have on the put the counter here then they put various I expect that these are some switches and I am usually

thrilled at this things. Like this you can probably build on small anything which you can do about the house.

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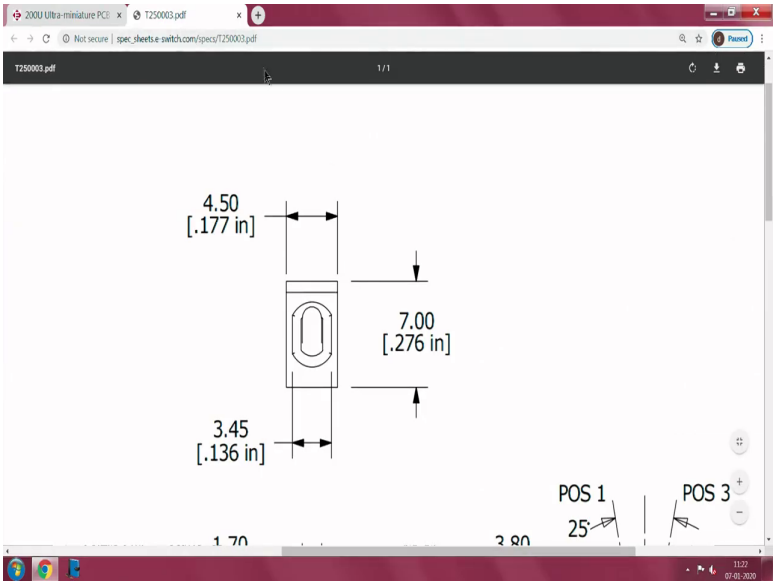

Let us say you would like to make a small home automation.

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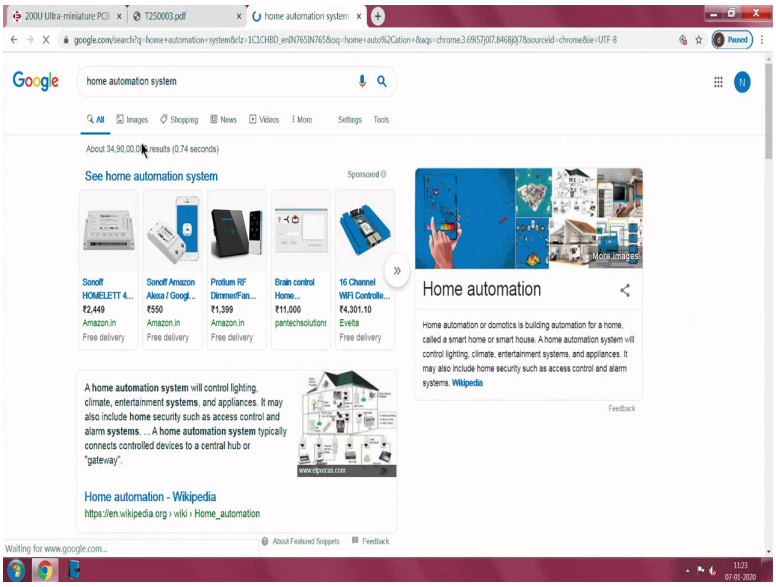

So, you see here lot of this devices directly use available off the shelf components.

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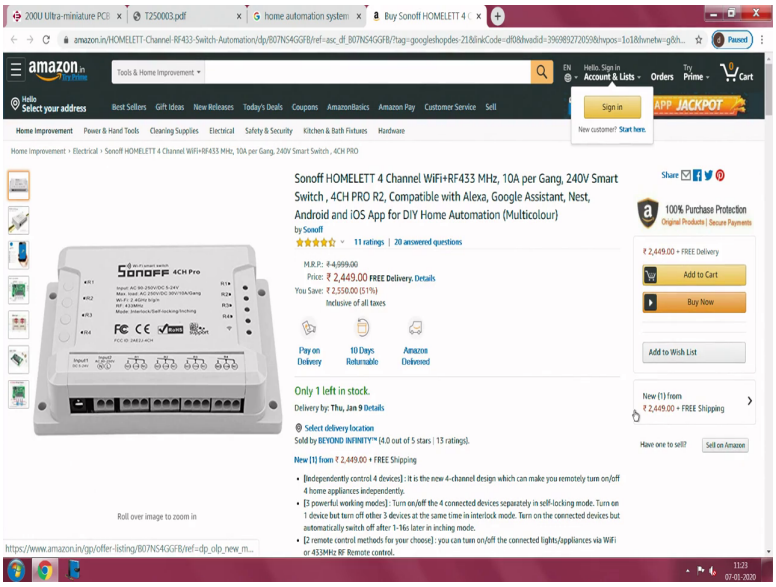

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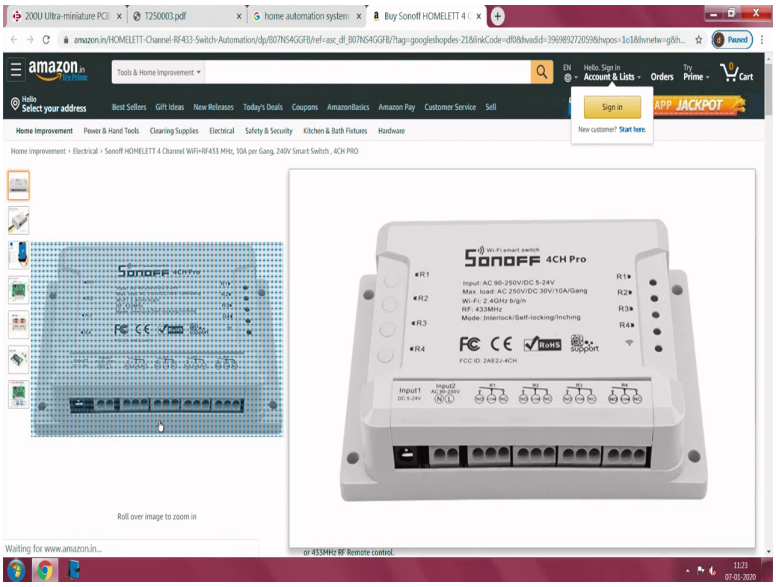

So, you have I mean you can read it for yourself; so, compatible with Alexa, Google assistant and all these things. You can buy one of these things and build a nice system around it.

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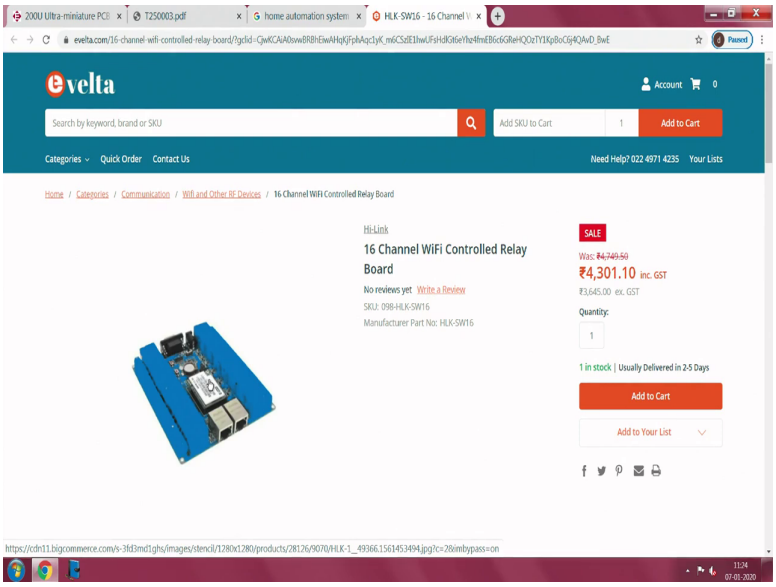

So, almost every manufacturer in the world, probably has these things. Say, somebody has made a 16 channel Wi-Fi controlled relay board. The highlight of it is we have this beautiful board here has all the relays and then all the necessary things are there. Now, based on this you can build your own much larger system.

And, they focus of it is for example, the full board in this case it is just a picture which is there. Now, you can probably procure the board or go to their website they will give you information about which are the input and output devices and how do you take this terminations out. Using one of these and using various things you can really build things around this as you like.

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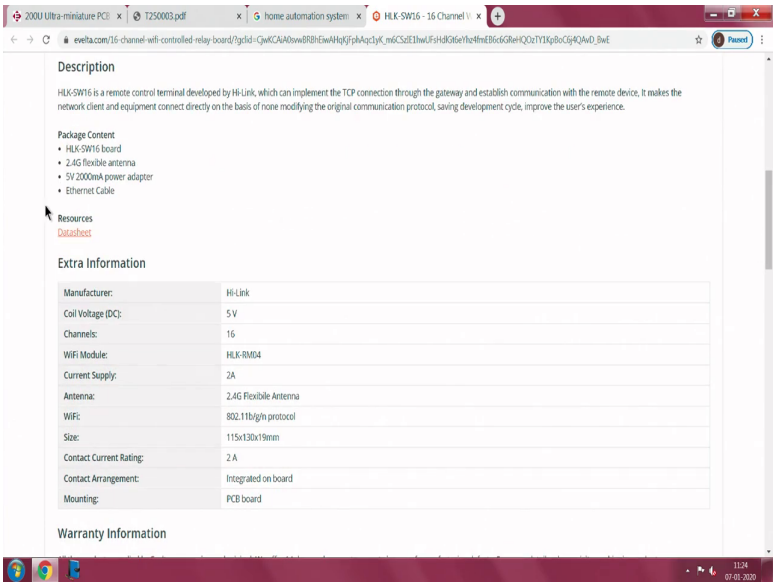

You have seen this. There is a place for an Ethernet cable and then you have fantastic data sheets.

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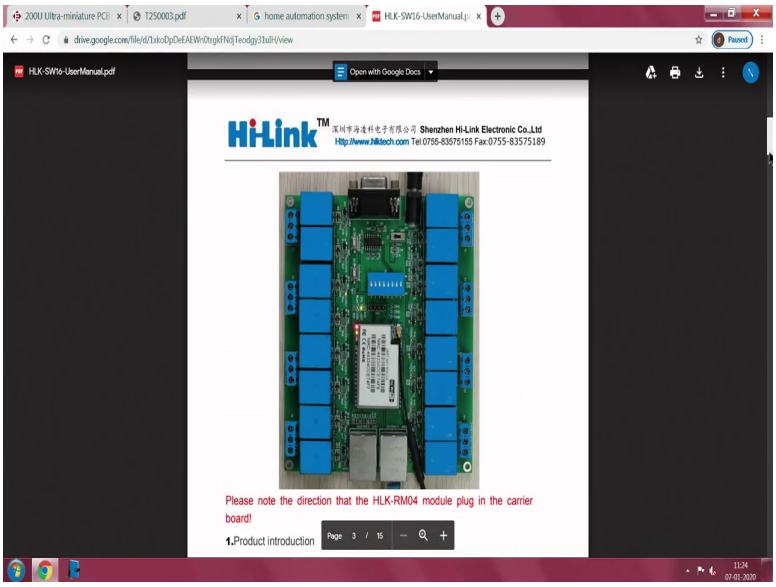

I hope I am able to get the data sheet somewhere here the full things here. You have seen here something else here there is a small settable switch. It is called a dip switch in which know you can set things up and down various states as you like something specifically and then how to make things here, how to make control and you see here.

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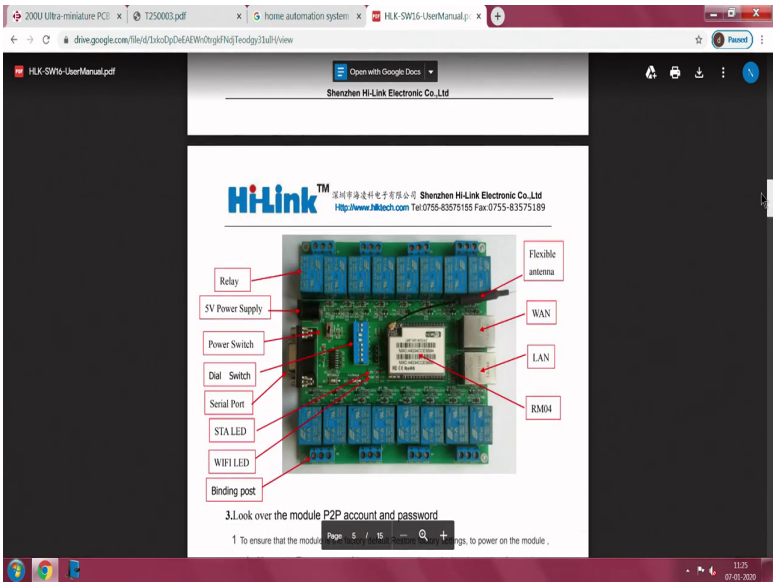

You sell everything what all you need including the switches, ports everything these are all built inside.

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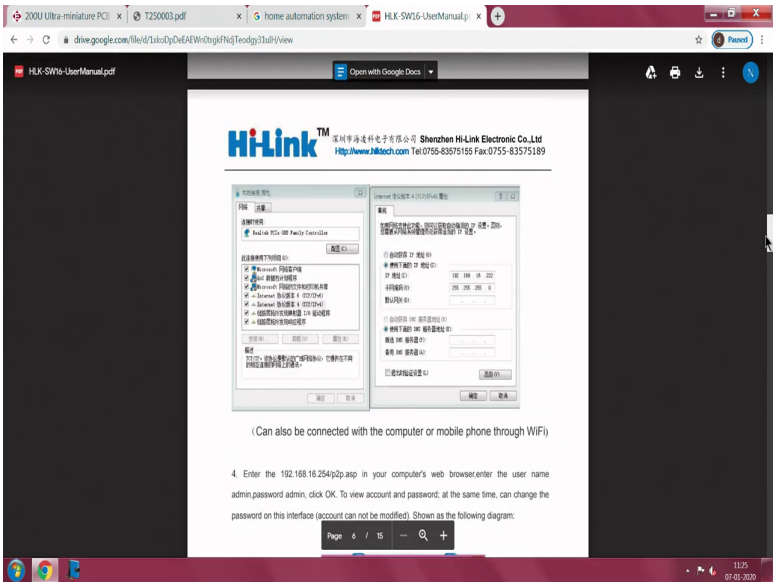

Now, what you need is once you make there will be a mechanical drawing here. You can access the try to access the mechanical drawing.

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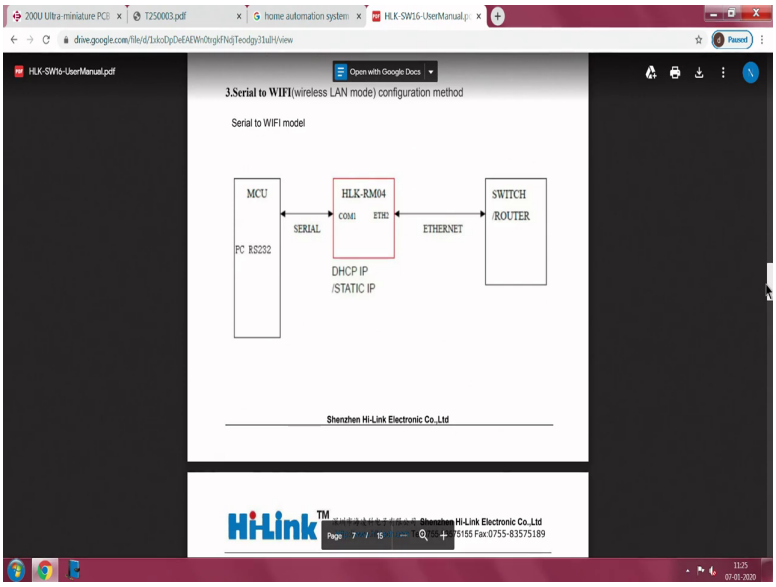

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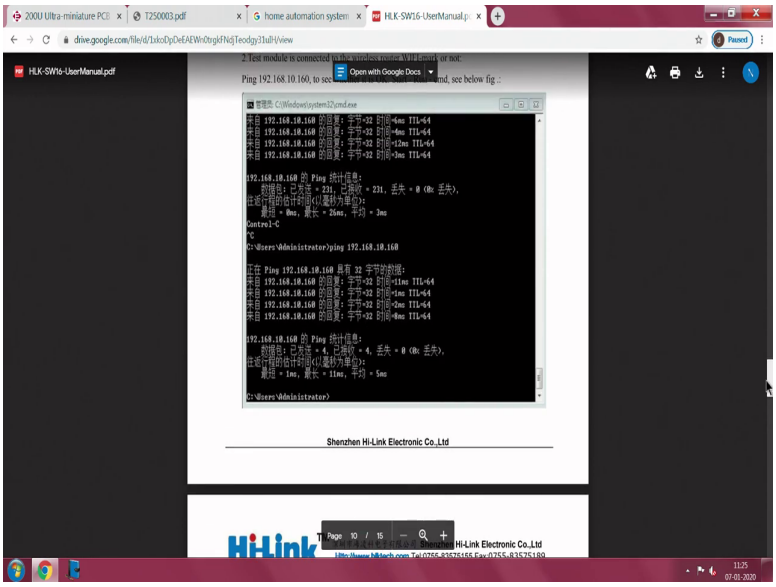

And, then make a module out of it and build a large system; probably you can import the code.

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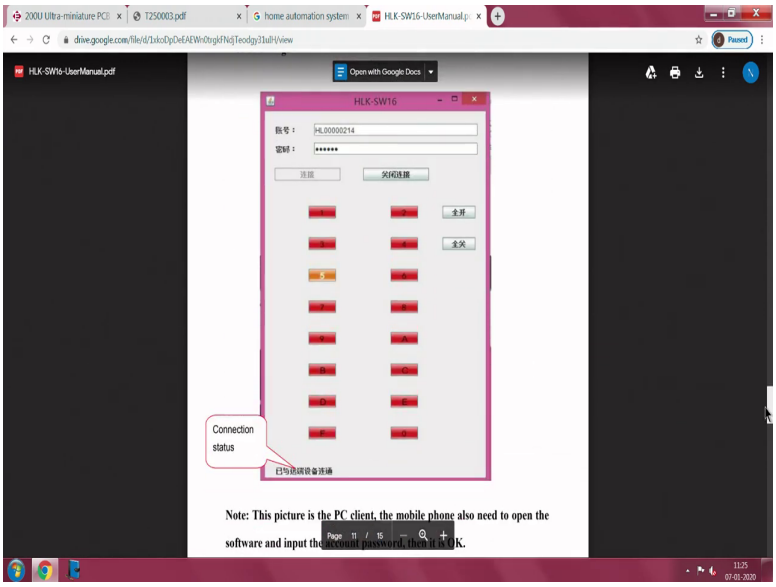

And, you can have your own beautiful system.

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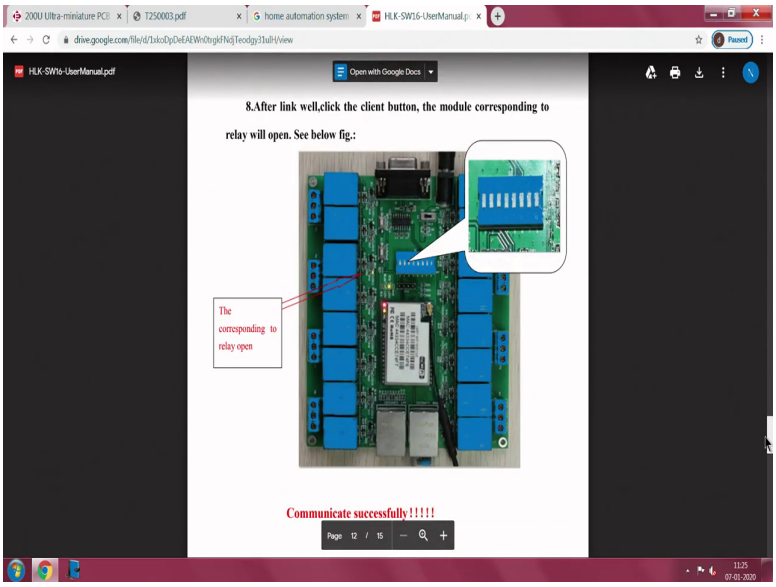

You see here they have given here click the client button, module corresponding to relay and so on and all that know all these things for both for testing as well as application of it. The focus of it is you need to now convert all this into a one small library component and if you keep the library component you can assemble them all in a small system and then you can make it in to a huge subsystem.

And, I mean sorry, relatively larger subsystem; the small units will make a larger subsystem. All of them can be made into a probably rack and then you go on, but the core thing inside is each and every component each and every things which are available off the shelf, it is imperative that you collect the information collate it and keep it in a convenient place where you can access it.

Now, with the chance of us to negotiate with other people it is very easy for us to go ahead and try to share this information. If you among your own I am the type of person no who enjoys having a this VPN type of thing among your work group you need to keep all these things useful, then it will be very very convenient for you to share among you and in case there is any change you can procure things which are which run for this production run this batch production.

In the next future, you just need to just change; imagine that toggle switch is not available or imagine instead of putting all that small LEDs and all that you have a strip which is much easier to manage. And, instead of the toggle switch imagine I just have a push button and I have something built inside, my basic concept is there I just need to remove that and then put all these what do you call tactile switches and then make a nice front panel and design turn around will be very very fast.

I hope I did not offend anybody. There will be so many youngsters are ready to learn like you. So, after you become you go to the next higher level you can teach this to the youngsters give things about it you need to monitor their thing and every item which you normally use can be converted into a solid model two things you have that layer concept something which is visible then something which can be used on the interconnection board or the printed wiring board and the panel details and the marking. Now, all of it is just part of one small switch which I have shown you.

So, I will stop here this slot time I have just about covered, I will continue a little more with small other components a little more sophisticated system eventually.

And, so thank you.