Electronics Equipment Integration and Prototype Building

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Lecture – 39
Low cost is the key

I interrupted the last session, because I could not decide which comes first; meaning, you take a non equipment and try to analyze the things or you start from scratch and try to build, so both are absolutely valid. If you remember I had shown this, very early on probably in the second or third lectures in this series saying; if you have to make something which is a hand held device and if you want to convince your teammates on what we are building, you make a cardboard model.

Finally, that is all that is related to this. And starting from there in the lecture around three sessions back I said; all the hardware, the mechanical hardware which puts everything together also can be modeled and you need to take the effort once. If you make the effort once of making a it is a metric fashioner, you can build a library; same thing happens with all the, other electromechanical other items.

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Now, have a look at this the monitor the slideshow here, I am sure you have all seen these type of small multi meters, nothing great or rather nothing I would not say nothing great; obviously, it is very very great, the amount of thought that has gone into making it its really tremendous. But then a whole thing is available for almost nothing, you can get a probably you know beautiful multi meter for 200 rupees that will come to some few 3 or 4 dollars.

So, if you see carefully there is nothing sanctimonious about it; this one has soft corners, this one while in general know this is squarish or rectangular thing, this one has a small waist here.

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So, one needs to work on all these things as we like; you see very early motors this one had a something like this and then we had this. Now, as we improve things, see what has happened here; suddenly it seems to have this dial like thing; which we can only see in music players, music players had this you know.

So, as things progress all the necessary hardware and all changes. So, what started was a switch and later on integrated with the printed circuit board, contacts; eventually you just have a jog dial or a some dial like thing which you are likely to find in a music player. This is where you continue to make various types of models.

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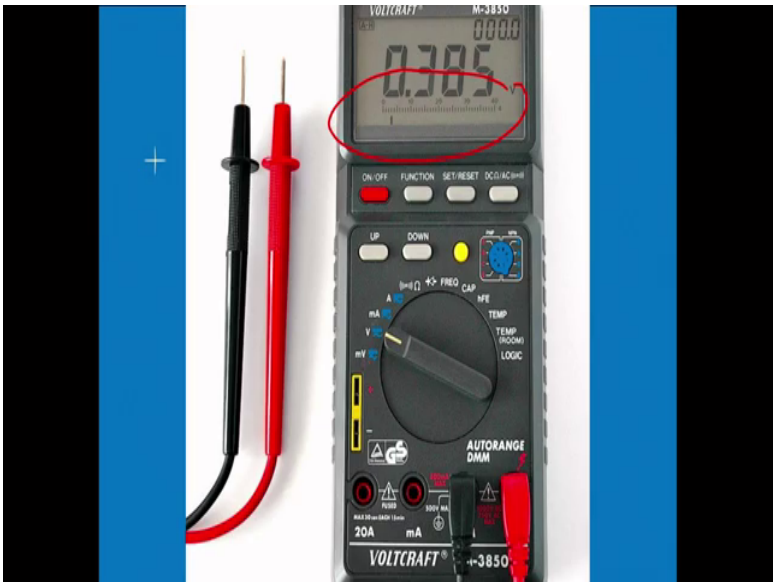

And why this model thing is required is? You see here suddenly we seem to have a very colourful presentation here and what, we are all familiar with this. One thing we are very very familiar is that, we have a dial and then it has calibrations and the moment you call it auto ranging, we have a little problem of trying to look at it. See what they have done, they have also put a beautiful a scale and what looks a little like a linear thing.

So, you know in this whole thing where you are, if you want you can be here or your whole range can be there and suddenly this does not, this is no longer a range switch; this is not related to the range, it is related to the particular parametrier measuring. So, we have something with the usual you know amps, milliamps, volts; and in the other end know, we also have capacitance, we have the gain, then we have the temperature and certain logic thing know all of them can be happily integrated into it.

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Now, before starting on this, you need to make a very very simple; I will call it a pre alpha model. Now you see here other options, none of them have really caught down; but just these are existing about maybe 40 years back we were existing. Occasionally these units continue to exist in the field, when somebody has to climb a tower and then take measurements and all you have everything. But the commonality between that and this is, you have a display and then you have a range also; same thing a display, range and you can tilt the what do you call display to suit your things.

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So, I just sort I will show you all these things and we are all familiar with it. Now this is where you come to the next level saying, can you enhance the product by giving small features like this. In this case the probes are attach to this, and you see here suddenly why I pick. This seems to very regular analogue meter, we have an analogue meter and then we have a LCD digital display, it does make sense. So, at least you know whether you are here or here or anything afterward further things you can read here. I am sure you would have had this problem, if you have a small printed circuit board and you wanted to use a tent on potentiometer and then try to trim the voltage; and any electronic this type of device will take time to measure and display.

So, even if it is a matter of few 20 to 50 millisecond, 100 milliseconds it will be very confusing over you to watch the display; instead you can always call this meter see here and after that read the display for fine adjustment.

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And I think you can, I mean you can stop the video at this point and observe what these are; including I think you will see what this is and then you will see what these are, here so many of these things attached to that.

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We have a display problem handset has dropped off do not worry too much about it, and fantastic things.

Now, the movement the electronic display has come you can do anything with it. They are even small what look like oscilloscope displays, there nothing oscillating or there is nothing scope about it; it has a display which shows various things on it.

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From here onwards I do not think I need to what you call go too much into this; but you will notice that, when you want to make a device like a keyboard, there is no point in trying to make a 3 D model out of it, because it is going to be expensive. All you need to do is, probably take a printout on a, A 3 sheet and then see which best layout will come.

Later on that can be that A 3 sheet what you are taking can probably pasted on top of a thermocol styrofoam sheet and try to make all these things. Mind you at this stage, it really did not take off as well as we thought; finally the good old quality keyboard is quite popular, it has come to stay. And see what is the fixed keyboard here; somebody has decided why not keep a hinge there and why not be break it into two parts.

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It really did not take off, these things to exist somehow they did not take off; I do not know whether these are only concepts or anything, because both the mechanism and those things have become ridiculously complex. So, with this we have this problem of various things.

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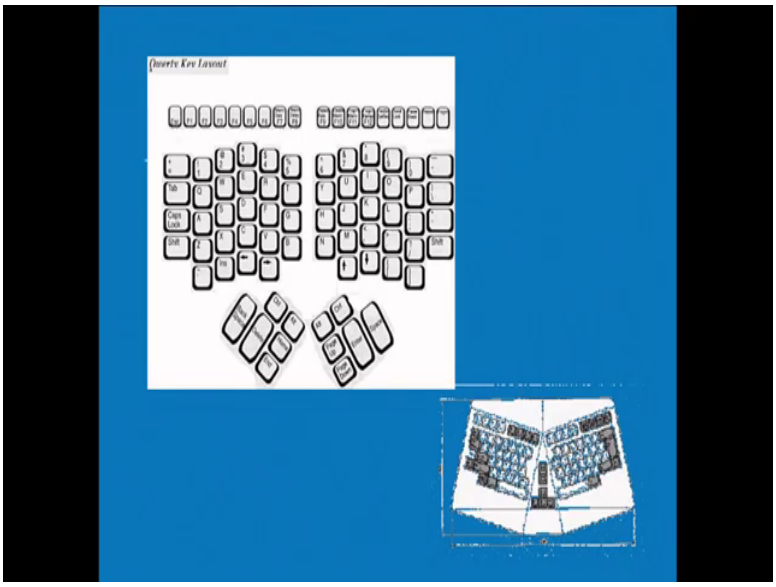

Now, you will see here, we come to what I was telling you at that time; most likely this is just a print, you can take this print and do what you want with it.

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And eventually you can make a mechanical part of it.

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Something looks normal; but you can for those people who are familiar with this other three dimensional devices, things like this can be done.

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But I will just call them a novelty, not even what spending time on it.

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All these come vaguely, loosely under the concept of prototyping other thing here.

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Now, in reality design depends extremely on experimentation and study; experimentation means not like a big setup a physics experiment or a chemistry experiment or a electronic experiments saying, think of various alternatives see how well one of them fits best. And there are people who know how to evaluate these thing; who have that little what is the immediate feature where the technologies are available and then you can regroup the elements and try to make a better product, this is where prototyping as we know it helps.

Now if you look at this, these all look very ancient; you have a I think you know what it is, things like the artificial horizon, things like the altimeter and these are all probably very old pre Second World War.

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Just after the first war, the early electronic revolution components look nice; some things from here I have change, some things have not changed. If you see the voltmeter and ammeter and graduation; you seem to enjoy it, will like it a lot seen this things are very very easy. Now some other elements which I thought I will tell you is saying, in spite of there being a big saying voltage there, it still repeated at the bottom.

Similarly, here if you see certain designations what we normally ignore is that, all the stuff needs to be on top. So, that in case you put something you can still says; we have amps, we have coarse and then we have this on and off. See very carefully, here they have written power and on; there is usually a little problem with in this part of the world especially India and all that, they write power here and it is conventional in India a switch the bottom part of with a on. So, end up with writing power then and on here, which is very very confusing. And if you write power off and then you put on here, it is again one more time confusing. In contrast at

least for this if you make the small jump and say write power on there and write off here, probably it make sense.

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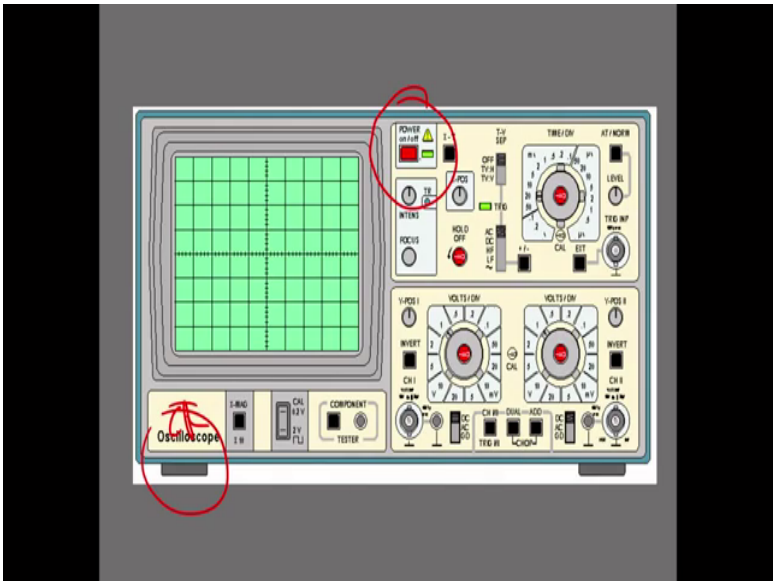

You understand this small nuisance can easily be done if you can make a simple cardboard prototype. Have a look at this, we know very well this is definitely not a an equipment; but you see how well things have been laid out in this. This easily you can do on your screen; any illustrated program will help, and moment you take a printout and put it on a box and show it to somebody, people will be happy. This was long ago made probably for a CRO Cathode Ray Oscilloscope.

Now, it is just a graphic display and then know whatever you want you can have things here. And then now you see the small detail I was trying to tell you, there is a power on off switch; and there is a green button which shows what it is saying if you press it, the button will go on.

This I prefer this compare to the switch itself having a lighted switch which is also possible. In some cases the switch itself a lighted switch, then things are little what do you call crowded.

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So, one can go on like this, just randomly I have taken a; I have just picked a few things from the internet.

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So, you have all known sort of things here, oh we have an element of something being disciplined. And I do not know whether we should call it a error or not; it is strictly not an error, but it would have probably made sense if you had put 50 ohm output here, same thing you know other outputs here, this designation on top would have I would have preferred that. But then it is fine, these are all you know expected things work here.

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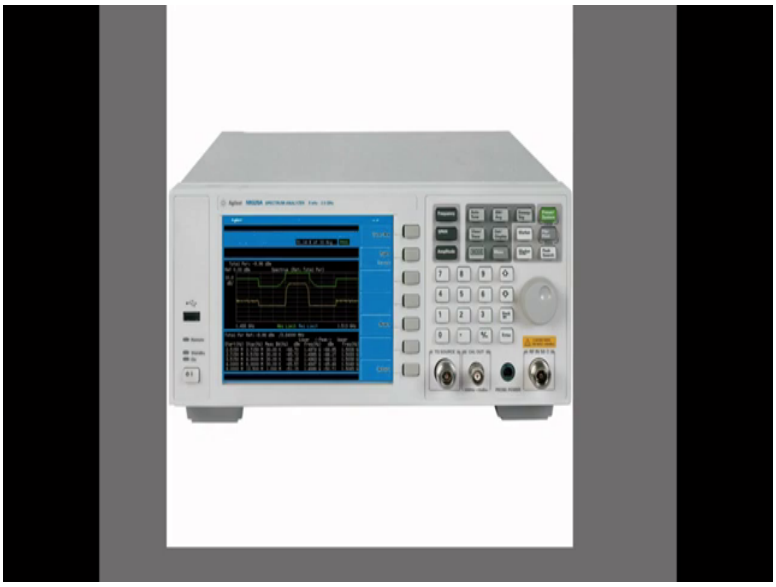

Now, as we go further, things have been very simplified at one level; meaning clutter is very less, but then a bit of learning is involved if you not to if you want to do this.

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You see here, a bit of learning that is all nothing great about it. Now we have come to the next thing the moment you have switches and all that; now why do you need to write any designation at all, why do you need to write anything here on this. Why can not the switched top itself have the designation, it will make sense to me; you have seen that know nicely, the key top is engraved with the designation. So, they are advantages; the advantage being that you have saved lot of panel space.

And this is where coming back to my earlier that solid modeling; if you somehow make this key top drawing and all part of it, you can always send all the keys for printing or engraving or in the case of the first prototype, you can even print in stick it on top of it. Which make sense; should it be on top, should it be big, should it be centrally align, should it be left and all these know designations can easily be taken.

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See here so beautiful equipment, really really tough.

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Now, just for demonstrating I thought I will show you, we have a nice display here; the moment you have a display here, why cannot we have directly touch screen. I am one of the people where my touch is not very good; it is other too harsher, too crude and it does not work.

Instead it is now customer a that you have regular tactile feedback switches here, which point to the thing this switch points to whatever we are trying to what do you call display they are saying. If you want to you know something some ranging it says, if you want to do the ranging you press this; you see here nicely this things point towards it, so that you can change this and still the same switch holds good. And unlike the touch screen devices, you have a hard this thing and they display.

This is where if you had just made a mockup and show it your colleagues, I am sure some of them would have said no this is not needed, you can as well put at a touch screen. And other should I voted out saying no, this seems to be better and let us leave it there. In the case, you need not have any touch screen device here, you can just have a normal display and then your keys can be separate. Overall it is maybe slightly inexpensive compared to the other one and this is what I was trying to tell you saying; where do you keep the key designation?

So, left top seems to be default thing; these decisions are very very important, it may not be too much important to what do you call a designer and most user would have got used to it which will where we come to stereotype.

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Stereo typical users are expected to know all these things, things are getting better, small element of color and ruggedness. So, this is an RNDIS (Refer Slide Time: 17:08) device which by definition are rugged, rugged, rugged, that is only thing we can talk about.

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So, we have so many of these things ready. So, we have beautiful device know which does various things what you like.

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And I do not pity him, I am sure it is a challenge, I am sure you too would have love to fly this device; but then you see what has happened one small thing you know, all that automation and then there is one I believe what do you call bypass switch which is hidden somewhere to take over manual control and you know what has happened.

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So, life is not that easy, while this is the little slightly older thing; you see here things know in slightly improved now. Now they have you know various things which are there; still not as easy as we think, things are improving; actually because of our these things have fallen out, but there is a beautiful display also there.

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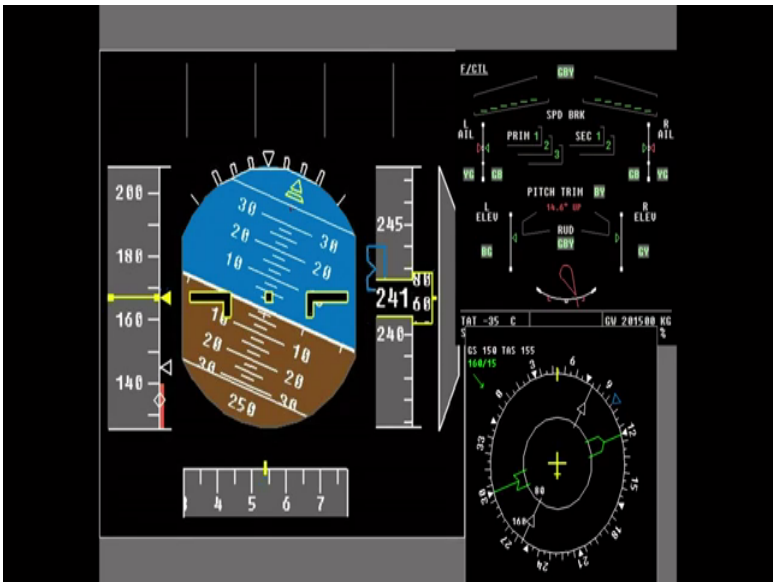

If you so remember this, not long ago people were riding in the night without the thing, now we have the artificial arisen.

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And then we have anything everything you want is already built into this.

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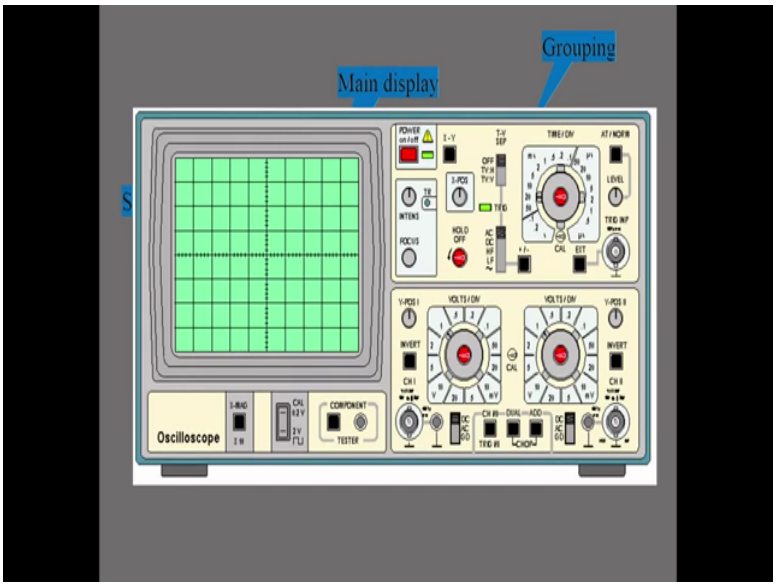

At this point probably I have exhausted what I wanted to tell you, I wanted to just stress on saying know; you need to make your own experiments try to work on them.

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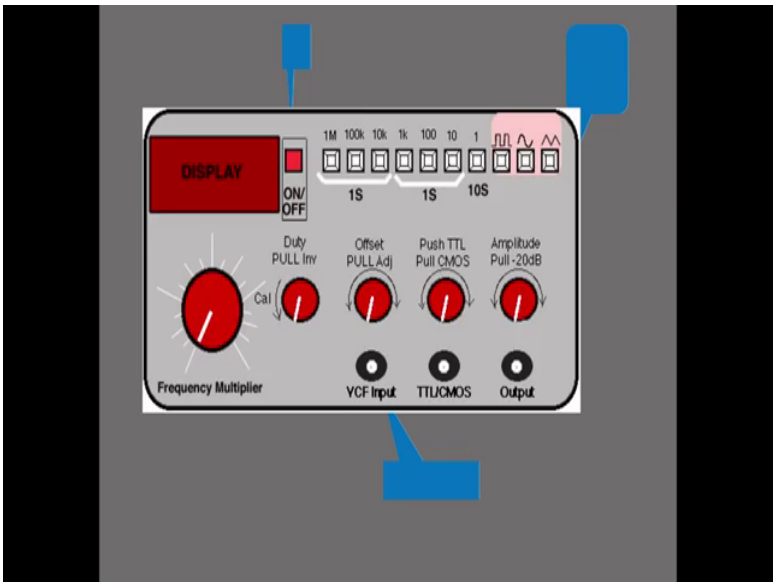

You see here, this whole thing is a just a simple a mockup.

So, I said shift top line, this is fine and then you see here know, while it make sense here know is it not logical to make it there.

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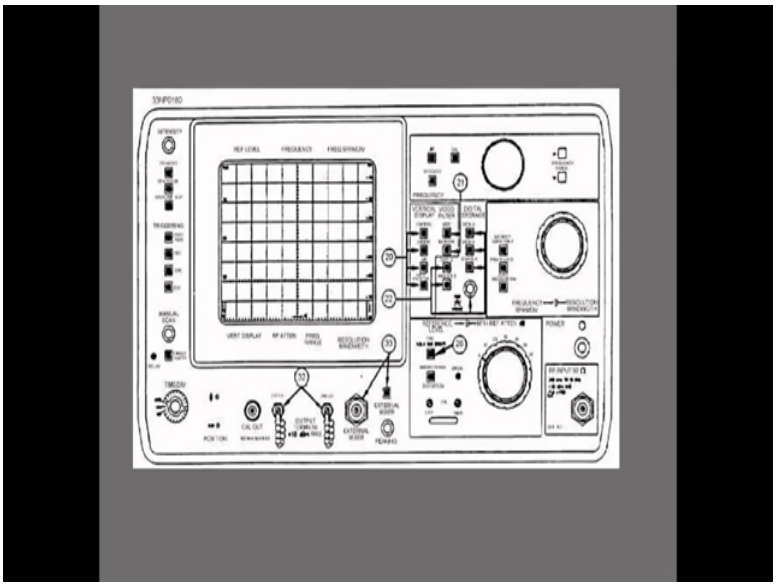

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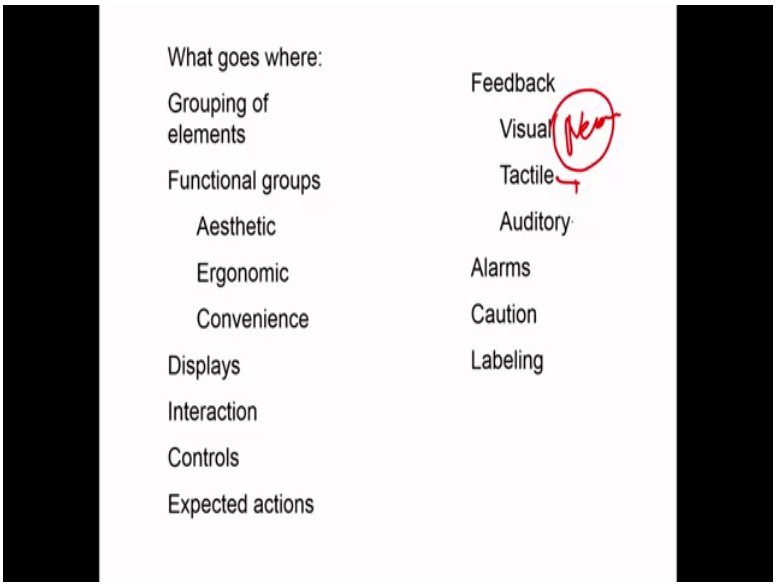

So, you can play with the colors and what all I have spoken I have try to put it here in a these thing, so that first of all grouping of elements and then the groups are should suppose to be aesthetic or ergonomics or matter of convenience. So, if you ever look at all the light switches in a any house, all the light switches we have everywhere; first thing we will notice is for a matter of convenience of the person who is making it and the thing they put all modular switches in a row.

So, it is a more like luck; if you can switch the first switch and then it switches everything and since morphs active most likely it will be the last switch. So, it is not easy, in certain cases directly from the what you call common practice is not easy to group things; there it is a matter of convenience that they group everything in one place. So, all the switches are in one pace, but a few things are still attention is done; as soon as you open the door and enter you

expect that, directly if you grope in the open side up somewhere know, somewhere the light switch for the room will be there.

And it is now comes to how do we find out where it is like that. So; obviously, you can have a feedback, you can have a visual feedback, typically the visual feedback in those cases can be a neon lamp. So, if you see a neon glow you will know very well it is or otherwise it can be tactile; all other switches can be flush that, one switch switches on can be projecting out. And in the case of various types of what you call new devices now, they will usually an auditory confirmation beep will be there. The confirmation beep we will tell you that a value has been accepted or it is being changed.

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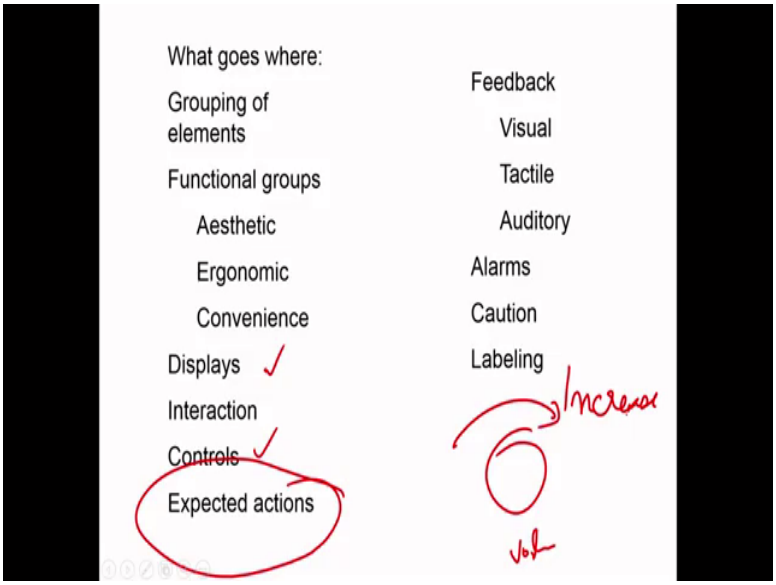

You have various things now where all we have to do; you have to do with displace, then we have to do it with controls and then various other thing, then here we have the population

stereotypes. I am sure you would have notice this a lot of times; if you want to increase volume, in the case of a volume, this is increased, good know.

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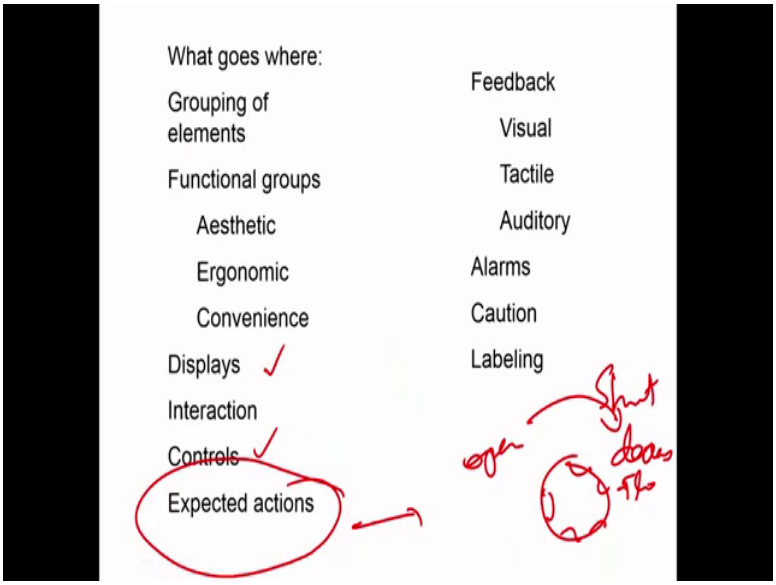

But in the case of any fluid flow; if you have a valve, it means decrease, decrease flow or shut and this means open got it know. Things like if we have a shower, if we have various things where there is a single valve in general; if you have turn anti clockwise they are opening the flow fluid flow, if you turn it clockwise you are closing it. Now the thing is, it will be a specious argument saying this that and all cannot they learn and all, no; you are not expected to teach people to learn all these things.

So, it is now accepted; now however, let us say there is not a multi turn valve, it is just a quarter turn valve. You have seen that know, the valves gate valves with a handle, it will be clearly indicated in the gate valve; on the gate valve saying close this side and open this side.

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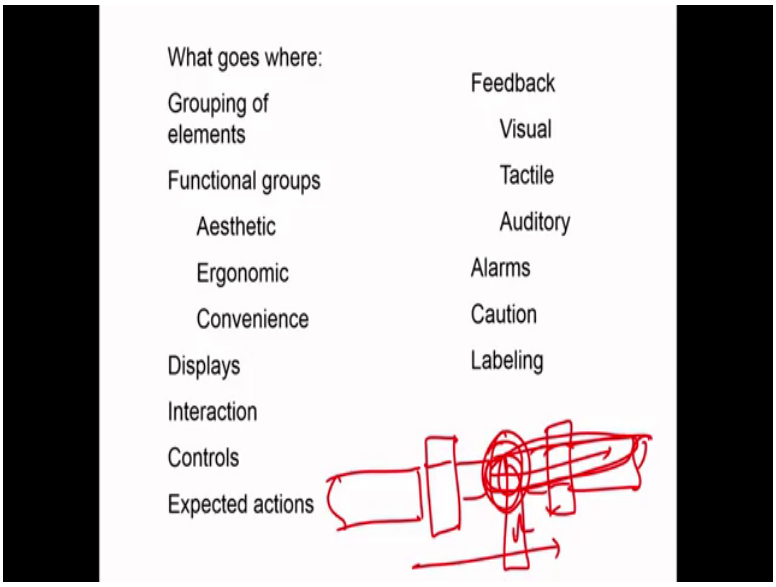

Now we come to the next thing saying, occasionally if this is the gate valve; it is a water gate valve, this is the water going in and let us say the water is flowing like this.

Now, comes the other thing, it is probably it is less logical you put a liver here and show how to do it and then this going to be probably close; but you will find all of the things like that. Some of them this is open, this is close, some of them this is close and this is open; why that is required is problem during maintenance or during the various other ways, you need to maintain a traditional thing which is there. Which is quite when you are in a small house by yourself; but if it is a huge dangerous plant which is making things, you need to follow certain norm.

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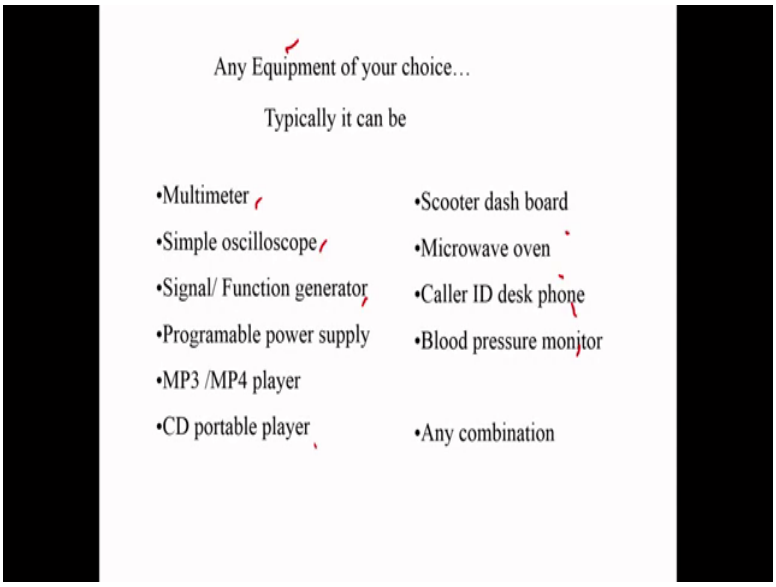

So, this is a typical exercise which I expect people to make.

So, pick an equipment of your choice; like it could be a multimeter or a scope or a generator and everything or this, this, this, this and all that know combination of all these and design a front panel for it. Design the whole equipment itself, but this was a control panel excising can you design something with it.

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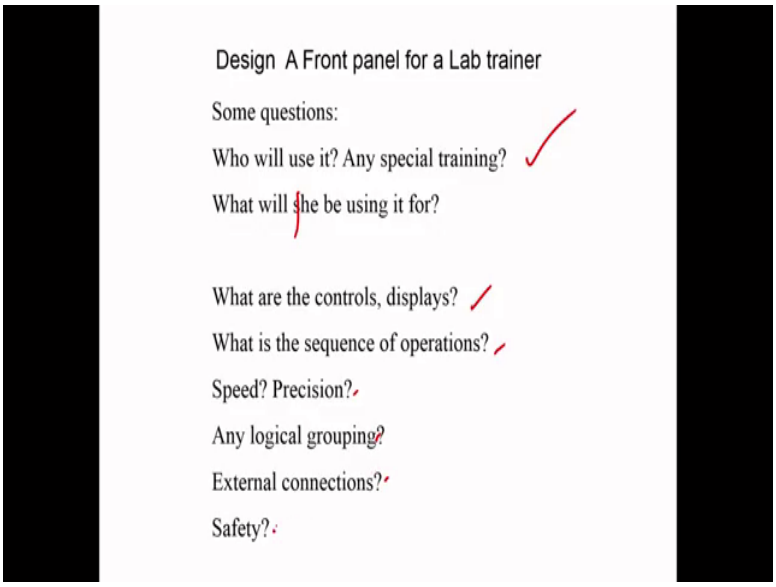

Example design a lab trainer; a lab trainer typically in the electronics lab which will teach you what are all various things. One of the first point one to start is, who will use it; are they children who have just finish their basic education and come back to the lab; or here know matter of gender and semantics, what will she be using it for? So, if you have a lab trainer, what is the function of the lab trainer, what are all the control display, sequence, speed, precision, logical, safety? You seen all these know.

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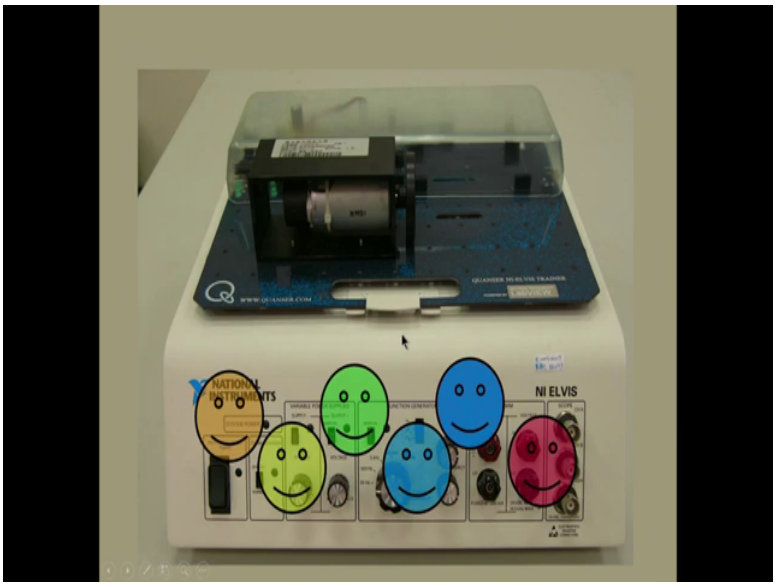

After this now, this is taken from a known supplier; then you have something on top you know, you have to make something which fits everything, can we make it that is a thing.

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Saying this typical exercise was which have been run and so we expected know the children to make all these things and in the end they are very well of absolutely. Absolutely know the problem once you do it, you will never, you will never forget these things. So, we have huge number of these material, which I have kept here and I think I have spent enough time to you about the whole series; the whole series is how to make a very simple prototype to do everything.

But when you make it know, spend a lot of time and making the library of components and typically the interface between the electronics that is electronic design automation and then mechanical solid modeling, you can do in your own way. And as you gather the information or as you improve your thing, life is going to be very very convenient; just down the line, may be 6 months to one year you will be fully prepared to make anything you want.

So, I will stop here and then let me say this is the final handshake, what do you call lecture. So, I can say best of luck. And like all other thing evolution, we still have something we have to work on it; but then the output what you do is you learn how to make these things. So, thank you and I have three other courses which have been already uploaded; first is about pure industrial design for electronic equipment and typically it is about enclosure design.

So, you can look it up in the NPTEL series; then the second one is about thermal aspects, which we are only demonstrating a few things like the heat sinks and how do you manage; the third one is about early rapid prototyping 3 D printing meant exclusively for electronic equipment, that is small typically in something which you know it is not very big. And this one is about saying, how do you use your simple tabletop cad and get started with the whole things.

So, you need to collect a little information on existing things and then start make a small cardboard model, present it to your what do you call team. And if you do not have a team, if you yourself are the team, you need to work out with two things; that was the last example on the computer I showed you, had a few keys, then had a display, then the keys were arranged in different format and then the display is on top.

If you now make these things take them out and print them or in your case if you are the soul person or anything you know, you can still use your the rendering which is there on your screen and get started. Having that is a starting point, working inwards is easy compared to randomly placing things on a computer and now wondering where to place what, and you end with a slightly sub optimal space. And so far the one what I have telling you the, thing is about a flat 2 D illustration.

But eventually if you make proper 3 D solid models, you can also arrange things on your wherever it is inside; so one of my student says he has actually a program which does what all I was talking to you about it, it does all the front panel thing, it does everything components. But what I have noticed is still related to arranging components where purpose of interconnection; not from the industrial design point of view or from the product design point

of view. So, please take a start, make a start and hopefully you learn something. So, thank you, I hope you enjoyed the whole course. So, we will meet again.

Thank you.