

Physical Modelling for Electronics Enclosures Using Rapid Prototyping
Prof. N. V. Chalapathi Rao
Department of Electronics Systems Engineering
Indian Institute of Science - Bangalore

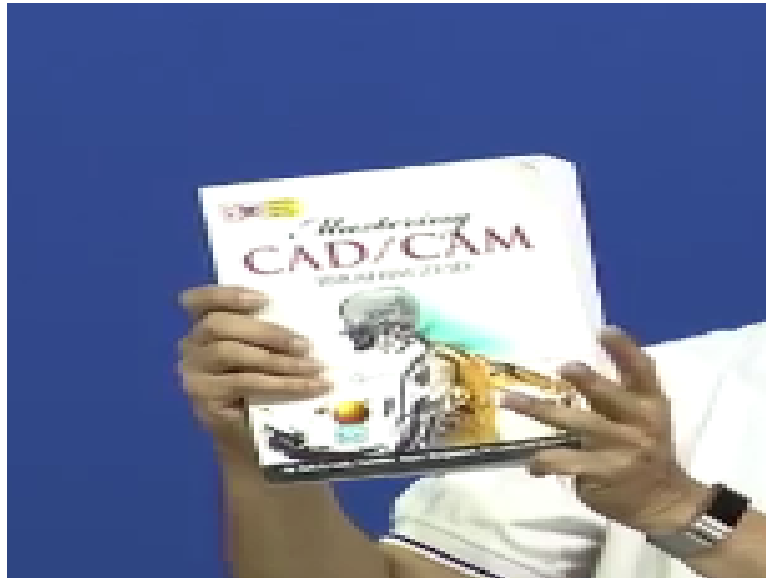
Lecture – 35
Creative Design Work

Hello, ah right hello, so let me start with me in next phase of the so called 3d printing or as a subset of in general, rapid prototyping for design. Now, the issue in design is that you know we need to make new products at one extreme, we make products only for our own what you call happiness about it which probably a bit of art, little bit of singing, a little bit of what you call arranging your own you know immediate environment like landscape, you do it for yourself.

If you get appreciation, it is fine otherwise, there is no issue about it, second is commissioned meaning, somebody likes your work and they commission it saying kindly make something for me, then finally when the Industrial Revolution came, this whole concept of making products for manufacturing in the industry has come about. So, if you have the patience, please go to the industrial design website and see what all you can do.

So, typically you have things like core 77, then you have so many of them know including frog design and everybody you know about it probably, has a website and their own opinion about I would not say opinion, they own take about what design is as it applies to their field and they are familiar, so I will put it aside, it is all about how to make new objects and to make a new object quickly, we need to produce it.

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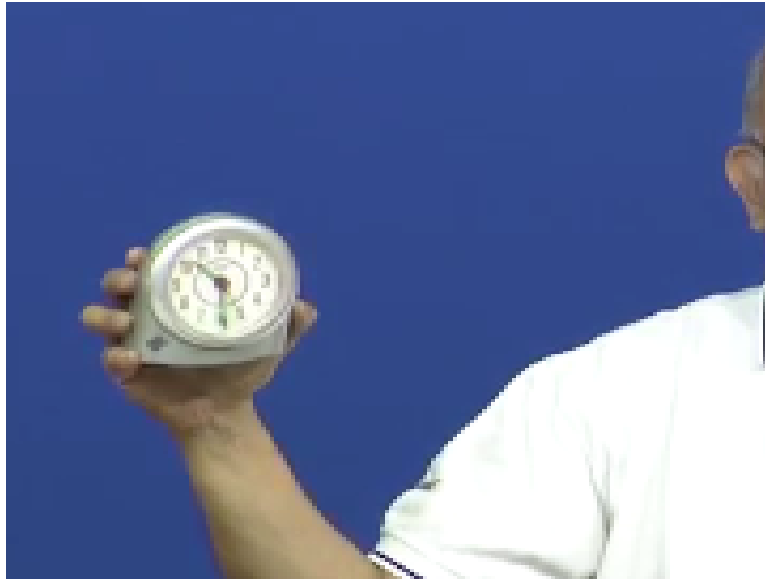


And show it to somebody either you understand what it is or you show it to somebody else, so we have a need for it, so let us say there is a student who needs to study for an exam, this is small book, in fact this is a very, very small book, you have seen it and last when I check it says Oh, 930 pages, I expect people are expected to read it. If you ask me have you read it, yes and no relevant purchase but not relevant to me, I have just thumbed a browse through them.

So, you see here, the cover itself it shows all about CAD/CAM, this book itself is actually quite old, the one we have is I do not know anyway, let me the original was very, very, very old, it says 2005, good enough. Now, let us say a person is preparing for these things here, you see here, it is closely packed equations, so these equations have 2 types. So, one of that thing is a little bit of theory identifying a particular equation and applying it in the real life.

Now, this is where one of my students wanted to make product which makes not learning, writing a test easier, so when you want to write a test invariably, you have a time constraint so, the basic time constraint is the test probably runs as per a clock.

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See here, I have this clock, I am sure all of you know, a little familiar with it something you know which as you say, not all people are morning people and some people at least they late risers, no think it is okay to get rid of the morning people but however, you cannot get rid of exams because exams seem to be the one that will give you a chance to be take a you know, we take a chance to go on to the next stage to get an opportunity.

So, the starting point is obviously a time so, right now there is no issue about it at least, when we grew up there is the wrist watches are not very popular for various reasons because I went through a strict school by which they wanted everybody to be about the same occasionally, they do now with respect to mobile phones, mobile phones are not allowed, you are expected to park it outside, same thing with all these high tech devices.

Right now, I have a high tech device and in this package know, probably it is very easy to cheat, so you have no access to a wristwatch or a pocket watch or anything and in fact because all of these things have Bluetooth and they have capability to interact with your phone and even if your phone is just outside the window, you can do it. So, you only have a clock which is a wall clock, okay.

And you need to time yourself so, if you have this wall clock like this, which is you know fixed by definition of wall clock or you have a table clock, the teacher points out at the clock or the test administrator points out at the clock saying the test is about to start at 10:30 and you have to write complete within 1 hour and in between, we would not like to disturb others, so kindly you to do not disturb your friends.

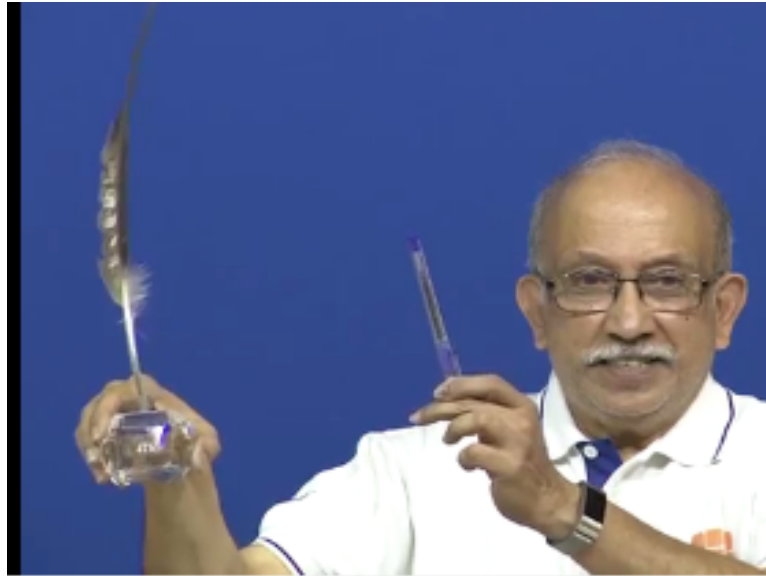
If you want to get the time please look at it and just 5 minutes before, we give the stop signal, we will announce it and exactly, at 1 hour at say, 11:30, you need to stop writing and turn the paper and blah, blah, blah and all that. Now, all tests have become, tick the right answer type, you understood know, they have usually, I will just to give you if it is a 60, what you call 60 minute this thing, at least one fourth of them that is for 15 minutes you probably have 15 questions where you can quickly tick.

Ticking time is important, they are familiar meaning, if you have a sequence know, suppose you have typically, you know say 0, 1, then 1, 2, 3, 5, you know the sequence know, 8 and so on and one of the thing is; they will give you the next 2 numbers saying tick the correct answer and the advantage of it is; once you do the marking that the teacher can have a template which she can say or a machine automatically recognize the optical character mark.

So, we have OCM and OCR I mean, optical character recognition character things, all of them depend on pencil, all of them depend on total time and how do you portion your time so, when people study for the exam, one of the earliest thing they do is; probably get this monster, big problem we have that is why use the example of something which is actually 60 minutes, so I will just wind it.

I wind it to the next this thing let us say, 30 minutes but still it is a distraction, I have to keep looking at it for every minute or every 5 minutes and then when I turn it back, horrible sounds it gives, most irritating and you will not be motivated for that because of the this thing and in fact one of our famous universities have made an alarm clock which if I we try to start it, he will run away.

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So, now one of the students wanted to time his experience in responding to answers, so obviously something and all is required in it, one of it is about the timer. Secondly, you need to write and tick, so I have gathered various objects, I am sure some of you may have seen it. Again, this is just to demonstrate to my students in the class, we have taken it, this is probably, a candle holder, okay.

And it does not matter about the you know; faith or religion or anything this candle holder, looks a little like a; okay looks a little like a teapot and a cup has been created which looks a little like a blue teapot. Right now, I have not you know put everything originally, there is an idea of keeping an LED lamp here, which was only distracting, if it is only a decorative piece it is like that.

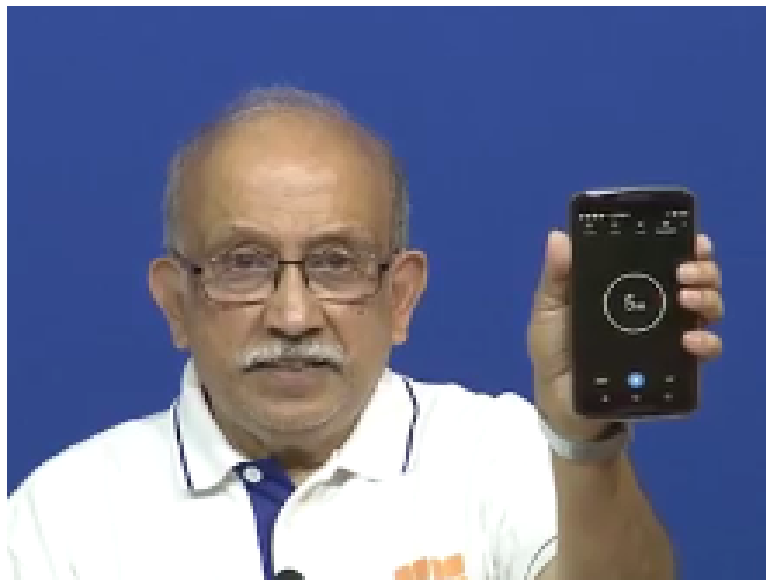
Otherwise, I can always fill it with some this thing or coated inside with the blue colour thing and if I change the cap, I get a different colour. For some reason in classes and all that know so called royal blue is preferred for this now, it comes to this quill, you seen that know, this quill has been made intentionally to be a little decorative, seen this and there is a ballpoint pen refill here, there is a cap here, I can pull it out and I can replace it whenever I want.

Can you see it, I have a ball point refill, so it was a good idea to make this, so what I do is; I start my test and I try to learn how to answer my things, how well I can hold it. In real life of course, you would not have it, some of the places they give a pencil, some of the places they give a pencil saying, you can you know what you call, tick with the pencil and they also give an eraser, so that in case you want you can change it like that.

Eventually, towards end you are allowed to ink those things permanently or alternatively, if you have a you know good dark pencil, you need to you know darken it and it stays and by mistake if you do 2 of them, we have a little problem, latest online we have been avoided this but generally, people use a marker here probably, it is a genuine I know what you call ballpoint within liquid ink.

So, 2 things good enough is it not, we need to make a product which has all these capabilities, one of them is; as soon as I finish a tick, the timer should give me lap time; a stopwatch lap time, in fact I have seen some mobile apps in which a stop watches are built, so let me check if stopwatches are there.

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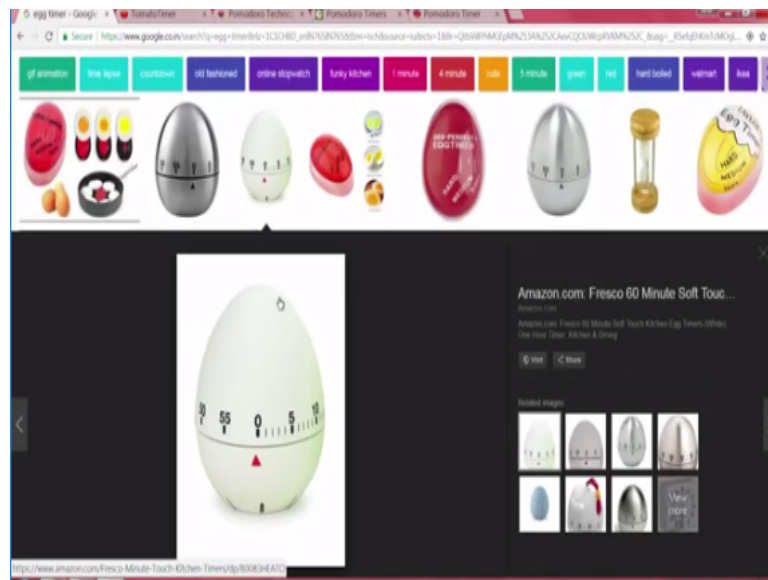
This is a normal stopwatch with it has been started and various types of alarms and all I insert but this that the project I am going to show was made long, long ago and it is a dedicated thing so, you do not need to recharge, you do not need to do much and it just works, you understand know. Now, apps are available but then these are little distracting, if you talk about apps now, there is slightly distracting.

So, we have this nice thing and whenever, I want I can make a lap, you see here how long it has taken, I have a big list of these things, I can probably upload it to my what you call favourite storage and then try to use these things, only nuisance with this is; often unwanted distraction will be there because I do not; it may be trying to place calls or some internally that system know may try to get into maintenance including updating and all that.

And while some of it is okay, some of it is not so good okay, the latest one, you know the thing which we had was saying it had a thumb, what do you call this fingerprint recognition also, so the teacher you know takes it and passes it around the class and I know it does everything, it marks attendance, another variant of it is using this thumb thing that is after I finish ticking, I give a tick on the that you know OMR sheet.

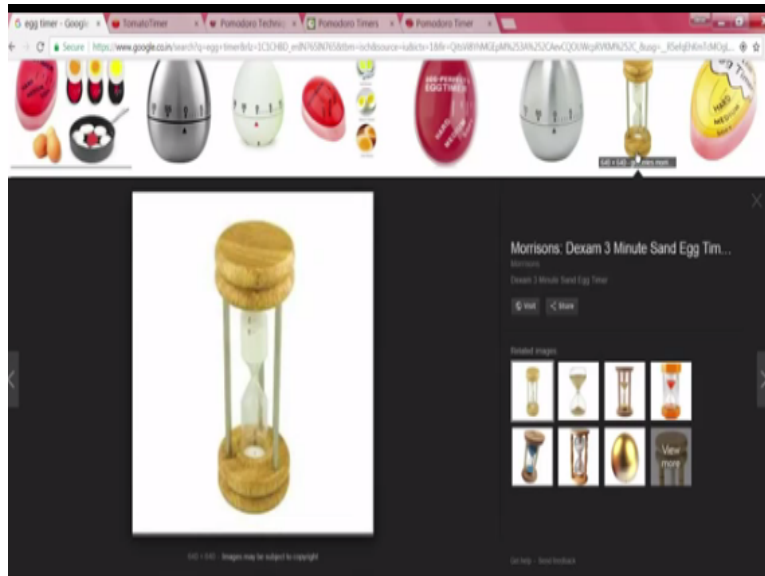
And then I also press this, if you tick, press it like that it will give me a total list of questions and so on, while it is okay to one level, it is not a full product because anybody can make it and you cannot sell it as a separate item, so which will bring back to the things which I have here.

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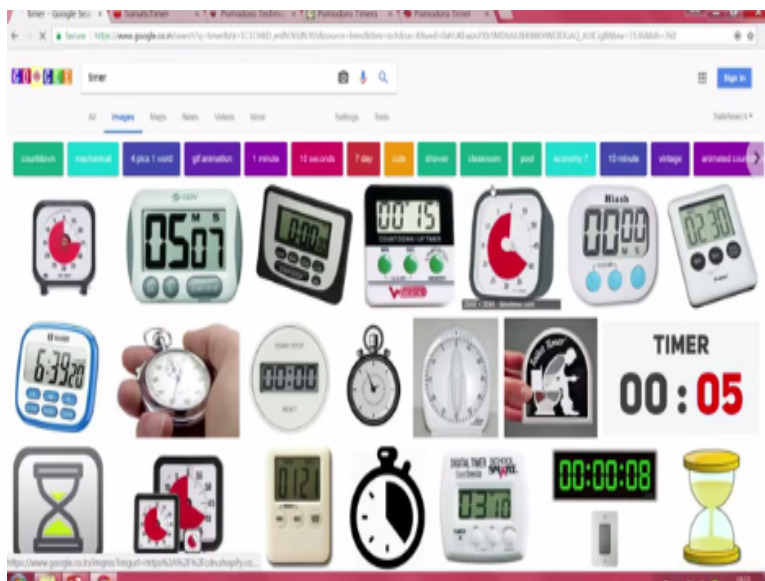
So, if you see here, started looking for a timer saying, I am sure some of you are familiar with what is called the egg timer, so that it will not be distracting, I will show you the egg timer eventually, you understand know, so we have these egg timers. Similarly, we have you know various types of okay, anything related to this.

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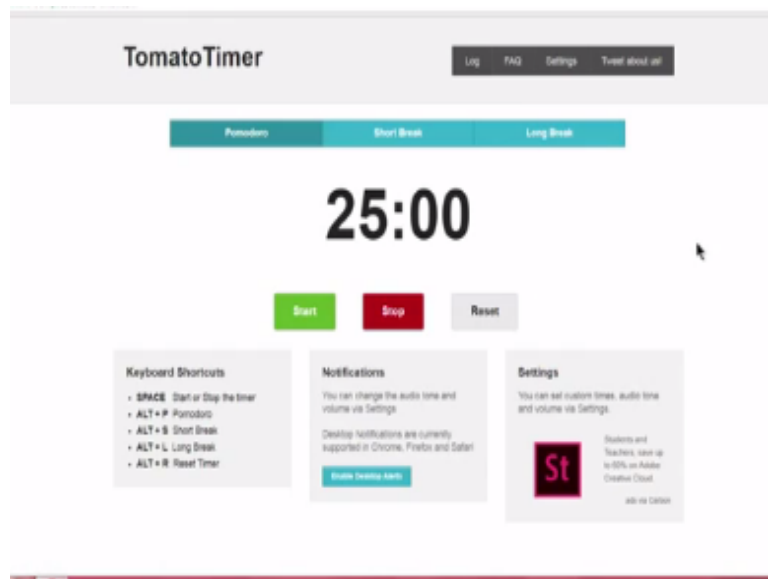
So, good old, 3 minutes sand egg timer like this, so you put the; what you call hourglass turn it over and it this thing. I have, I mean later on I will show you, advantage of; disadvantage of this is, it is available for a specific this thing and it is a novelty okay, may not be ideal thing for us to use it in an examination.

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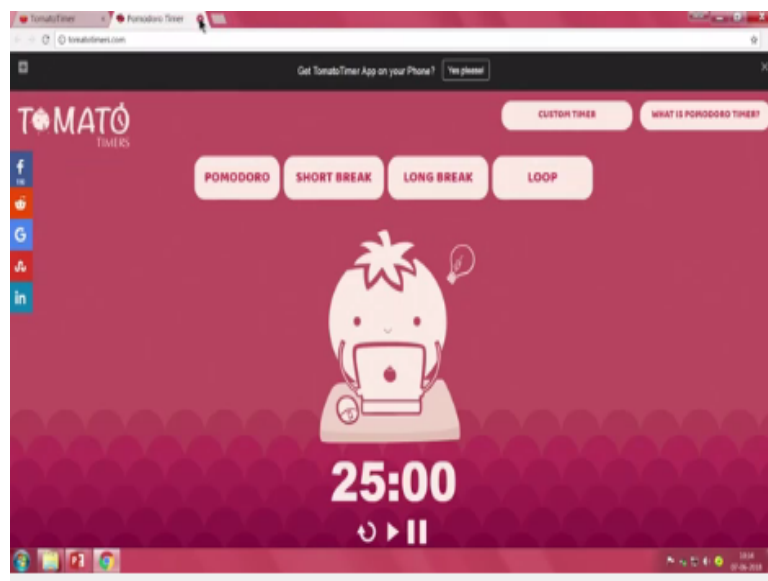
So, I will now go back again instead of the egg timer, I will just use the word timer and see, so if I want a timer, it just available in the market, we have all these things, you will see here, I am sure some of you probably have it. It is typically a kitchen timer but all these are not exactly convenient and nor not products which will fill a gap in the market, they are all there everything what we know is already there.

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But then this is when one of our students you know, he was given the problem, he thought a lot about it and came out with it and online know, you have all this things saying, I do not know what it has. A company is called a tomato thing and then maybe you can use it to make all these you know various types of objects, so we have beautifully you can set whatever time and all that.

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I am sure you have noticed, you are not allowed to take it into the, they what you call that has to halt, so our student inside decided to make something else, so before showing the final result, I showed you the necessity for a pen okay or scribing device.

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Then, now these things also have come but it is not likely to be used okay, I think you know what it is, it is one of those stylus, it makes sense in case you are using a mobile and you are doing it but other side, it has a normal pen, you can tick and all that.

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And I am sure, several of you probably have access to this, this is nothing, this is something which I can write on the screen and there is a stylus here, there is a pen here and then there is something else here depending on this know; I can point out and so on like this. Now, can we make a product which satisfies all this, so somebody has tried to what you call work on it?

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Kindly see the presentation now, design of an ergonomic pen and pen stand with timer, so I think it is obvious here, first of all know, a lot of time has gone into trying to understand what is the; what you call the situation and try to solve small problems at a thing and make an integrated project. Now, when you go to the night, I think early on I may have shown you that what you call one more book timer, early on in the thing if I have it, I will see if I can have it.

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So, please have a look at this lamp, which I have here, can you show the lamp, you see here it looks good and in fact, it even works, so when you want to read a book use it but not very good when you want to take it to an examination hall or anything because the situation is very different and very and still there are multiple things. So, now coming back to the presentation made by my students.

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Please have a look at the presentation presented by all these things, you know acknowledge; Suganya, Nilkanth, Richa so and so on, so many of them, Mahima and so on. The starting point was this saying, see here even the name has been chosen probably, it is an illuminating both you know, you get illuminated about your thing; how to improve yourself plus it is illuminator, so I will say at the left know a little bit of something is there.

And you see the beautiful organic shapes it has, there is something here okay, then there is something here, there is something here and then there is almost an inkblot; looks like an inkblot test, you can spend more time on it later what an ink blot test is. The thing is it is a blotch free simple device which can be made.

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So, why I showed this particular one is; we have this saying, technical objects invariably end of it being crude geometry which is not that pleasant to look at, in some other condition I can do. So, nature, the inspiration always have been smooth curves, so when you have time and when you have the thing please come back and check what it is my, what you call feather is here and then I have some ripples in a tank.

Then, I am not very sure whether it is a sand dew or it is part of a fish or it is part of a hand or you know enhanced. Next, you have something which are probably leaves, then you have a bark, then you have some things which are probably you know organic. Then you have you know random shapes, then this is a feather basket saying the inspiration for your products know, should come from various things which were familiar with one of the things is straight lines are not so great.

Because if you see all these know, inherently there is a beautiful flow in all these things, so flow should be natural then even ripples know or they are not like what you call road blocks it is just that they make, then everything should be organic, it is not man made naturally, it comes here.

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So, now have a look at these things, you can read it yourself, I will slowly move it here. Allow me to; I mean what you call, start here the thing is the students know, have built as much of I know intelligence and the things which they have built. Now, if you see the organic shape itself, can you see here there are 2 small dimples here, dimple here then, probably there is a dimple so that you can hold it and take it.

And there is a very attractive thing, instead of making it into a what you call a box which previously I showed you saying, you know we have a plate which has 2 things and all that know, this timer sits here, at the time of going to press or the time of making this, the display is were not I know, organic but right now, it looks like know, some other way they can make it. So, it is possible for us to, for example, project these from behind on to a screen here.

Or project a time directly on the wall or on your paper where you are doing and then even you see various buttons and all how well it is and the important thing is; it is a pen and a torch with a designer look, you see here this is a pen and it has 2 LEDs here and there some 2 black things, I am not sure what the black things are, to light up your desk and serve as a reading lamp along with a pen stand with a digital timer, keep monitoring your time.

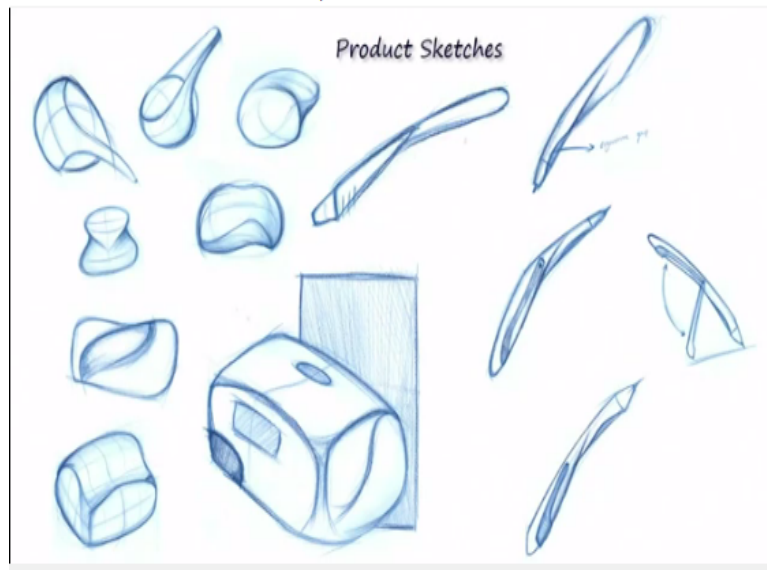
So, the idea is every time you pick it up, the moment you pick it up, it starts. In case, you do not want it to start you can always use your left hand or anything or you can give it delay, so the magic is this concept and this positioning in your mind saying that is very critical, a product positioning yes, all that you require a lot of materials which you buy and all that know, you buy them because of 2 or 3 considerations.

One of them is; it has been position has been created in it saying, I want an object like that in fact, I am ready to pay a lot of money just for its various other things, so even when you buy any product, one of the thing you get yourself involve is probably, the aesthetics of how it like, so tremendous amount, you see, the designers often build on this aesthetic thing.

Do not look about the designer clothes and all, they have a purpose the very fact that you have noticed them is partly the purpose is solved, leaving that designer clothes apart if you see all the clothes are and I will use the word, apparel and any of the body things, any of the environment everything and all know especially, the built environment thinks somebody has worked on it. Now, this is about the reading what I call reading aid.

And then this whole positioning was created before the product was done, you understand know, it is not as if somebody has made all these things put them together and try to make a product out of it, you see the thing once again, this whole positioning the whole thing know that was part of the exercise, building the other thing was only incidental and this.

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So, they come with this thing saying, how do you now to play around with it. So, in 3 or 4 stages, it was presented to their own peers and their peers have said yes, yes, we will make it like this, I have no clue, I cannot explain what goes on in the mind of the designer, it looks a little like a mouse and it is already has firmed up into a nice shape here, can you see already a nice shape has been firmed up here, okay and this part, this part here probably, refers to all this strand part of it.

This part here refers to the pen part of it so, life is good absolutely and now you see the 2 black things, first of all there is an ergonomic grip saying how well you hold it, which is not solved very well in these things, then there is a stand also, if you want to use it as a reading lamp you just you know push it down and then try to use it as a stand without in any way compromising on the utility of the whole thing here, seen this.

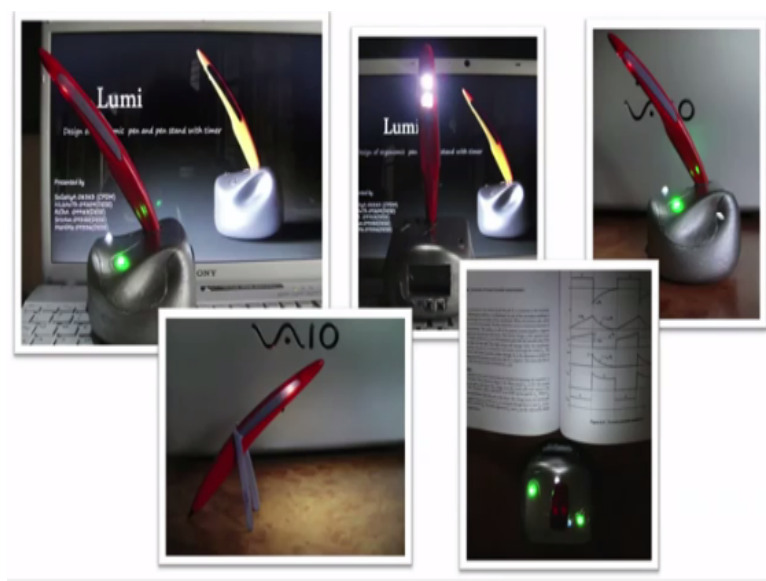
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Now, you will come to the second thing, a lot of it, it not just stopped here, how well you can see it and how well it prints, so I do not have the original what you call, now if you look at this object, well everything looks fine, this is in principle know, a flat surface with a mild curve, you will not observe the curve, okay and that curve is only taken by this one window, which is there.

In this case, it is a thick acrylic window which if you make these things touch and the printed circuit board is probably a flexible PCB or a PCB which is made in 2 parts, so we have one part here, we have one part here and one part or it is flexed in attached to here at the back, so you have this beautiful display which is there and you have this pen which all the stand and all this.

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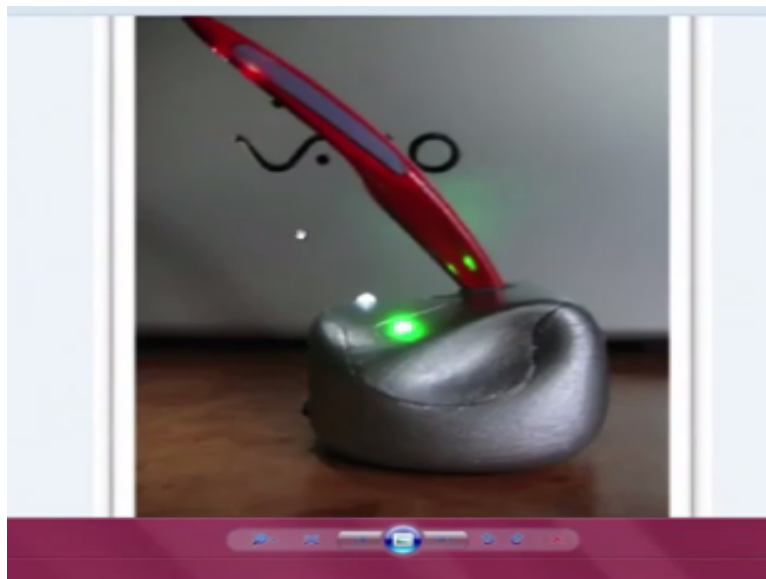


And eventually, this was printed, I do not know. Can you observe this here, not very great, is it not, this is the printed thing, so if possible I will spend a little time, I will try to what you call, get this picture out or if it is a composite, I cannot do much and I will say what best I can do about it, you notice here it is not that clean as we think it is, is not it, not clean, it is still granular and okay, you can just say it still makes a thing and then at the back know, I am not selling, I think you know what it is?

The students are also trying to mention what these things mean, if you have a chance know, look up that logo and decide how it has come. So, you see here various use case scenario saying here the LED light is on, while it is sitting here and probably this is what was produced, this is what I have been showing you so far and this is the actual piece that was they managed to print about it.

Why I wanted to show you is; now if you see carefully, so lot of effort has gone on how to split it into 2 parts, you have seen it here know, there is a line which is a split line, why this line is required is whenever there is something changes, you have it in all your cars also. So, let me look whether I can get a little closer.

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Now, you will notice that it is not such a beautiful structure, it is still crude. But then obviously, a time was a constraint and a lot of time was spent on concept slicing the product, whenever you want to make it their best what they could do the students have tried to build it and probably, try to finish it. We insisted that they show it to us in the unfinished state, it is very

easy, we just send it a little and then after that know, first round of let us have some filler similar to what you will use in your car especially, different bumpers and all.

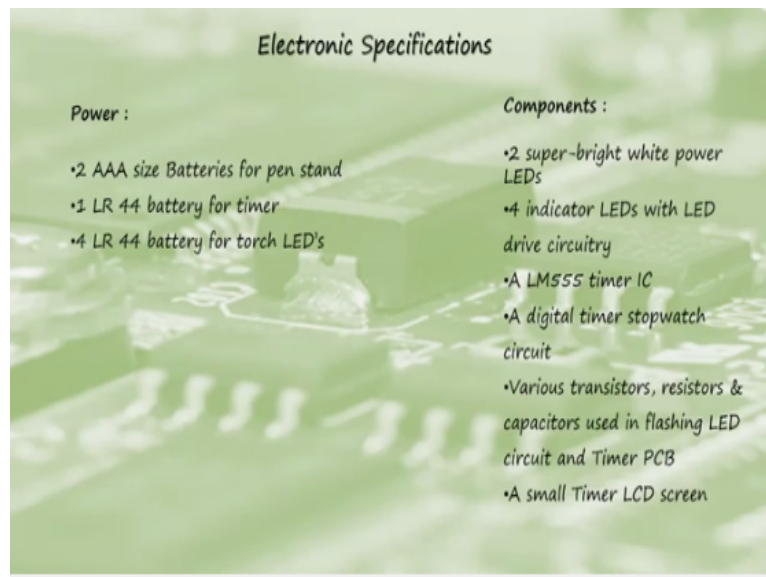
Again, send it again, filled send it and later on know, give a paint and a lacquer over it and we can get whatever pictures are given there and other thing will notice here, can you see what is here, this is charged why; by pushing it into this, so when you are not using it, you just park your pen here or you put it in the pen stand and the pen gets charged and then after that you pick it up and start answering your; answering your question.

So, here you see the what you call, the computer in which know in the front they have kept it and they have shown it and in my opinion, it is very good, it is a very good thing but then this problem with all organic shapes, you understood know, the original concept at something else now, the actual printed thing had, you have seen that know, a small grip, so that you do not drop it and added to that at the base probably, there is a rechargeable some cell inside.

So, all of these things can easily be built around using the usual things and then, you see the actual use here, you have seen this here, it is a book and actually, there is a you know that pen is there and then you can light up the book and reading it so, it serves both the purpose of lighting this or in the case of this is only for practice but however, when you actually you know take the administer test here using the same what you call that ball point pen.

And you can use it as a marker, even if it was a pencil, it is not impossible and you see here the amount of area that is covered in this and all are neatly taken care of.

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Now, if I go back you have seen this, Triple A batteries but they are rechargeable they have I know either way, you can use it you know charge it outside or put it here, then LR 44 for the timer which is why you require LR 44 for the timer? Because we need to hold the time and typically, LR 44 is a size and they come in both 1.5 and 3 volts also.

So, LR 44 size 3 volts also is available but conventionally, you know you get 1.5 and then 4 for the torch LED's, so $4 * 1.5$, you need a minimum of that so that the LEDs will work here. So, we have all this stuff, super bright white and then LEDs with circuitry, a timer, a digital timer stopwatch circuit and various active components and a small. It is an LED screen wrongly; they have written LCD screen probably; it was written you know much before the thing has started.

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So, the advantage being I have now something which actually works well and to me it was hanging on top, I do not know whether this actually was placed on the book to me know, it looks as if it is added but then this object looks fine meaning, they have made something which you know follows the shell and what do you see the marine and water crustaceans.

And probably, it is another stand and things like that so, the topic is I feel partly covered say, the topic is partly covered saying in case, you are looking at organic shapes, they are not that easy to produce but then not all organic shapes need to be very bad.

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If you see here this is also a little organic, can you see here a little organic to the extent if you see on the side, there are a few things a few curves or anything. But the essential part has been made as much as possible, this is the earlier things you understand know, this is a little earlier you know things which we are trying to get now, with this is with the advent of mass manufacturing in injection moulded plastic.

But then this continue to be the mainstay of most process, I do not know this may be around, the design may be pre second world war but this object was you know acquired in 19, oh, probably 80. So, a 35 years old, so thing is it still works and basically reliable it you know works on the timer and even if you see these, the amount of time that has been spent on you know making all this.

And this is embossed a dip drawn part and then, this is probably spot welded to this you understand know, there is a bit of spot welding and there are lot of assembly and this has to

float otherwise, it would not give you a knock and then, we have ever present handle, it looks a lot like the alarm clock which we both love and hate, is it not, very surprising thing is on worked is you do not want to get out of it.

And then, on holidays you probably get up early; early enough that apart you see we have certain elements which have been protected here that have been taken to this including there is a what you call a buzzer, there no watch okay, there is no this thing. Then, you have a time making device and at the base, things have to be a lot of power is required for this you see it is not hand powered anymore while it was a novelty at that time when what you call right now, people as going back to what are retro, so it does not have all the elements of a retro.

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Now, having come to the end, I will try to show you something which one of my students who also undertook my course has gone to this company. I am not sure where this company was, I do not know whether it is actually a trade name or it comes from a glassblower there and you see what he has given me, I am sure you will appreciate it, this is an original dip pen, so I have a Ink pot, I dip it inside I take it up.

And there are certain grooves here; these grooves seem to hold the ink. Earlier, when we had this quill system, this quill had those pockets, these pockets used to hold the thing and then, the concept of a penknife came, so you want to use it as a pen, you slice it with a knife and then the pockets hold all the ink and then afterwards you can start writing it. Now, this one has been made by a glassblower, I mean that thing sounds a little Italian possibly, it is Italian now.

The advantage being already it has a nice blue colour, I just need to dip it in ink, the moment I dip it in ink and take it out, just sufficient ink comes out and after that I can start writing and if you ask me how much does it write, these are all generally used as portable, personal portable this thing, so people used to carry a small book and they write a dairy like thing, so typically it could be, they used to have called you know quarto and you know small what we call a pocket book imagine, you have a pocket book but which is open like this and you start writing whatever it is.

So, one sheet there is a little less than an A4 sheet, in this writes, every time you do shake it and then keep writing it by the time, you come to the end and then when you flip over this, you again dip and do it here, so that is a what you call, classical recreation probably the concept maybe I do not know 100 up to here, 100 years old. This is my new this thing, I like to hate it well I say, every element is there every element looks crazy in this.

Saying, if I am making a new object, why should I try to make something which is crude which is taken from the other thing and I do not mind these things now, I have a beautiful what you call stylus here and depending on if it is a resistive or it is what you call capacitive screen, I can happily write things, okay and then now you know even this is dispensed off, now people can write happily here, capture it and take it back.

This apart since this particular lecture is about how to make rapid prototypes, if we were to create this glass object, we have to create a glass object, it is very easy to create this in your rapid prototyping, will you believe it extremely, easy to create it. All I just need to do is you make this and then you can make all these nice interesting grooves and everything probably, the scale will not be the same; I need to make it a little bigger maybe 2 times.

And then, once it works I can actually scale it down, take it to a glassblower and very quickly he will blow it and give it to us, it will not be of this size, it costs a lot of money, I do not know, I expect my student has paid between 50 to little higher than 50 euros and he remembered me saying see, he gave it, I said no I do not want to take it, he said no sir, it is not for you kindly, show it to your students.

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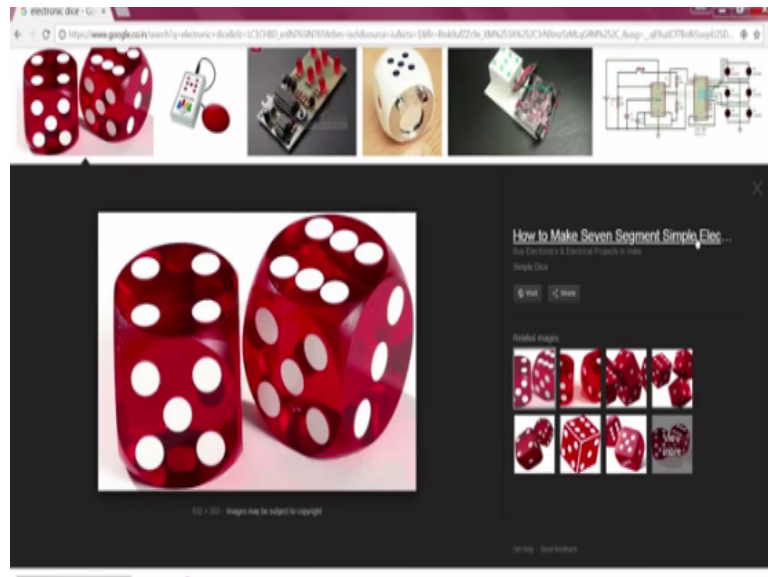


So, I can only you know remember him and wish him the best now, coming back to this monitor, let me go through a few other things which also have kept here yeah probably, if I have not already done it, I will try to come back to these things later on, I have all these what you call objects, I will see if at least one of them know I can print and this is what I wanted to show you, maybe at this point now you will understand that this object looks fine, absolutely no problem.

But then actually, when you print it chances are it will look like this, given enough time and given anything you can always do a little bit of post processing and make it look better but the issue is not about whether you can directly sell it like this or anything but the issue is once you have a concept and you have a working model which is made quickly that is this design probably of this, they what you call enclosure design probably that student has spent a month, concept as a group have probably spent a month.

And then inside the electronics, they have probably spent a month but that was parallel, hence you know finally, this whole thing was probably printed in 2 or 3 days, so when in a month you have an object that can be created including this element of novelty RO factor in it, you got it know, element of novelty and RO factor in because if you have to just make timer, which it does not go well at least, I do not like these things.

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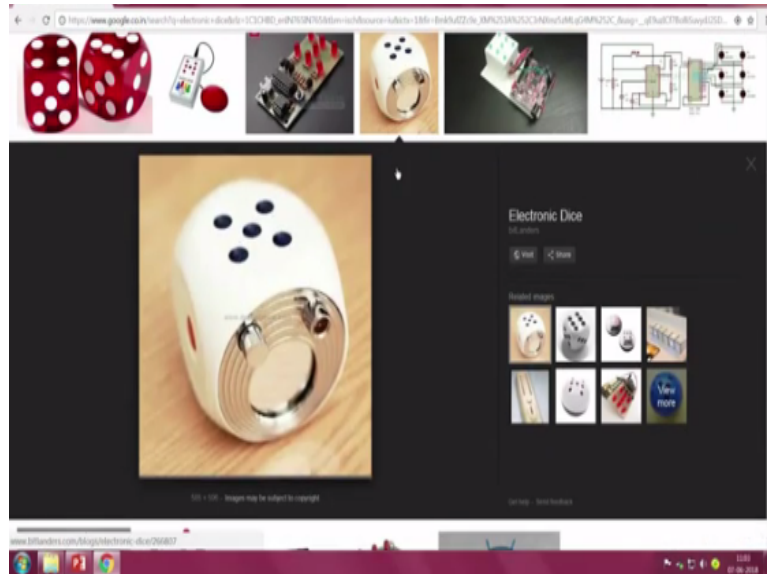


Now, let me go back to the internet and then show you some timers which I do not like, so this is one of my favourite distractions saying, say if I type electronic dice, I get all these you know the funny circuits, I have no interest in a funny circuit like this, neither do have an interest in a funny circuit like this. Well, it looks nice absolutely there is no problem about it being a nice because the focus here is not about how you use the thing.

What I am saying except you learn how do you make a dice here, so we have several of these dice circuits now, is there a way of can somebody make slightly better, you have seen this, this is a slightly better object, it looks a little like a dice and it has a multiple function also, in this case it is actually just something which looks like a dice but the thing is it is probably a night lamp, it counts the time in terms of 10 of seconds.

So, you have 10, 20, 30, 40, 50, 60 seconds it shows or it can be in terms of hours and minutes by changing the colour, first colour will probably show you the what you call time, second colour, I mean they are; second colour will show you the other things, so we have all these beautiful options, so to me somehow know, I am not very happy about those things, this is slightly better, how to make a 7 segment simple blah, blah, blah and all that you see here, we have an electronic dice and all the faces are there okay.

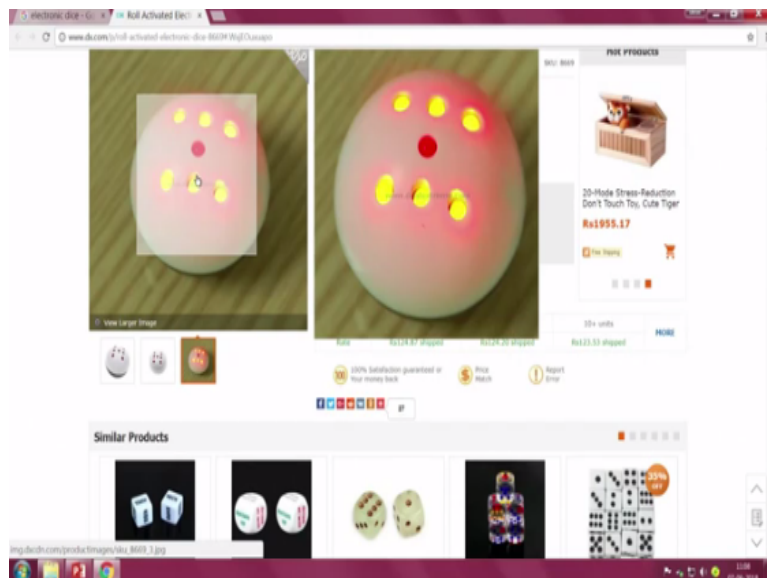
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So, I will show you something which is there and then you see this, this may or may not be a dice but still it has a few elements like you can shake it, when you shake it and eventually when it stops all the things will go round and round and you have a time that is displayed on its own. Microcontroller based electronic dice, so what they have done here is probably, only the top the dice what it has, it has been shown there as a some, what you call.

But inside it is possible for us know to have something, which you know, which actually rolls and then we make all the stuff in the end, we have a dice which actually works but no box has been shown here, so this is the beauty about this sort of projects.

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This is one more interesting thing, roll activated electronic dice, you seen this know, you try to roll it and then once they roll is over then have you notice something about it. Normally, if you

take 5, there is a centre dot, so 1, 3, 5 have centred dots, you understand know, 1, 3 and 5 have central dots in a dice like this here, say 5 has one, this thing has and you have it but 6; 2, 6 and 4 do not have a central dot.

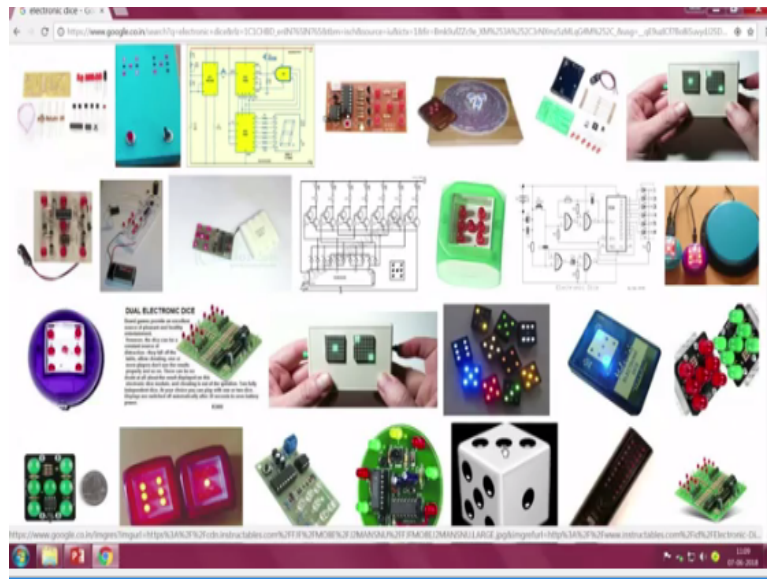
So, what to do about it in this case know, people do not mind, they have provided 7 LED's here, so role activated electronic dice also know is one of those things which is quite popular. Oh, ignore all whatever is here but you see here, then here the patients they just read through saying how it works and what all you can do with it different colours see here, probably it is actually made into a ball and inside the ball probably, there is a counterweight at the base and little flat portion.

So, what you do is you shake it just like you would do an ordinary thing and gently you know make it such that it will sit back onto the original base and these things you know give a what you call, a random rotation and then one random thing comes out here, so we have things which are built you know nicely like this, we have so many of these objects if nothing else, you can make various other things objects with it you understand know, so we have I am very happy to have actually you know what you call helped you in looking up a few things here.

And see here this to me is something which you can very easily print in a rapid prototype thing, why rapid prototype and why printing is the outside object being circular I mean, being spherical you can always sanding it is easy, you understand know take a sandpaper and in fact wet sanding, if you have you can start with probably, 80 or 100 and then finished off with 300 or 400 and if the material is good naturally, it will stays good.

Otherwise, you can spray it and lacquer it and you have a beautiful object and you can build various types of intelligence into it just staying on the table still randomly, it can what you call change colours, give you numbers and all that it will be a good conversation piece and the novelty and people will buy.

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So, if I go down, I have more and more and more what you call beautiful objects like this here. So, some of them are little simple and some of them are like this okay and this is even better you see, can you see something here it is lighting up, numbers are lighting up here, can life be better than this, then can you have dice with other thing, can you have a tetrahedral dice meaning, it says 3 triangles and then you make it what you call sphere, where they it is sliced and the 3 portions.

And then maybe its behaviour is; you have 4, so you can (()) (47:16) make with 4, which people suspect we do with our grading, so we have you know, we have ABCD probably, a tetrahedral dice is easy for us to roll and then you know get a beautiful grade for the students incidentally, we do not do like that. We spend a lot of time and I know preparing ourselves to everything like this.

And I was lucky today to have some current things which are popped up on the outside, so thank you, I will stop here, we will continue in the next session where I will see if I can actually connect my; I have a laptop here, I will see if one of those objects can be created, one of the thing is for example, this dice which has the 7 what you call, openings meaning, I will create 2 sphere except one half has a small flat cut you understand know, this sphere with a flat cut and one half.

So that when you roll it comes and sits there and then I have a display which is on the top which I may or need not make holes, if it is made of a transparent materials, the LEDs and all can light up from inside you understand, the LEDs can light up from inside, you can see it, so if

you see several of these latest things like air conditioners, which need to stay on in the night, people get distracted by the various blinking lights, displays and all that.

If the display switched off, a display comes on lightly and usually, directly behind the panel, there is no red cut out in which you know you can see everything and all that so, several of these devices are you know which are visible outside, do not need to have a red window, you can see the colour of it directly through a thinned out section of the original material, so thank you.