Functional and Conceptual Design
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Laboratory Exercise 6

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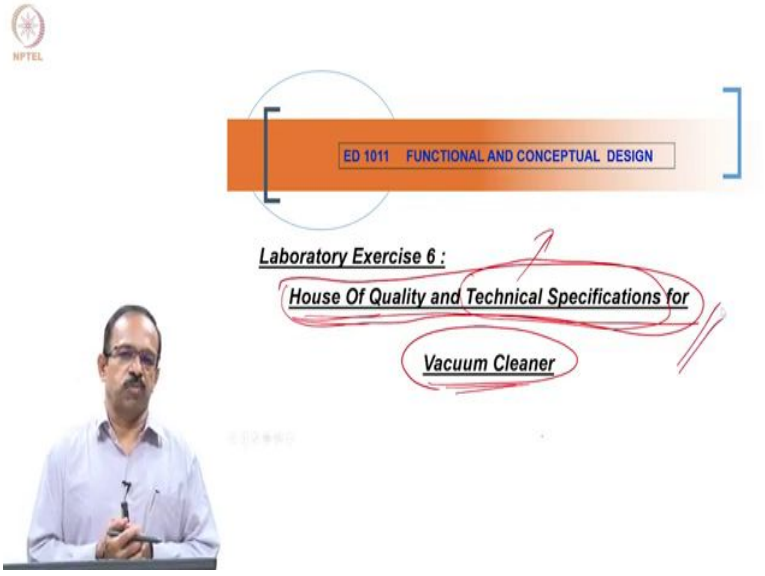

Hello everyone, welcome back! So this is the 6th laboratory session that we are having in the Functional and Conceptual Design course, in every lab course what we are trying do is to look at our theory, whatever you learnt in the theory and then see how we can implement that for a product in the lab or at least practically how can we use those principles for redesigning a product. Hello everyone welcome back, so this is the 6th laboratory session that we are having in the Functional and Conceptual Design course, in every lab course what we are trying do is to look at our theory, whatever you learnt in the theory and then see how we can implement that for a product in the lab or at least practically how can we use those principles for redesigning a product.

This is what we have been doing, for the last few sessions. So, in the session also we will do a similar exercise, this time the product will be a vacuum cleaner. Most of you will be aware of this product. So, most of you will be aware about this product vacuum cleaner, you might have used this, you must be having this at home, or might have seen somebody using this product.

So, as usual we will do the dissection of the product, try to identify all the main functions of the product and then try to get all the parts identified and then look at each part finding how this part is contributing to the main function of the product. But, as an exercise to reinforce our theoretical learning we will be doing the exercise of preparing a house of quality, and technical specification for this product.

If you want to redesign this product, and you know the customer needs or you can identify the customer needs, how do we use these needs in order to develop the house of quality, and technical specification for the product? And you know what is a house of quality, and you know what technical specification is.

So, a technical specification is basically to convert the subjective needs of the customer to an objective value and then use this information in the house of quality in order to compare the products, existing products with the products you want to design and then see, what should be the target values for this technical specification.

So, the house of quality will give you the target values for specification; it will help you to compare the products in the market and benchmark the products in the market and as well as it will help you to identify the technological conflicts and the challenges that you may face in designing the product so, this is what is going to be done in this experiment.

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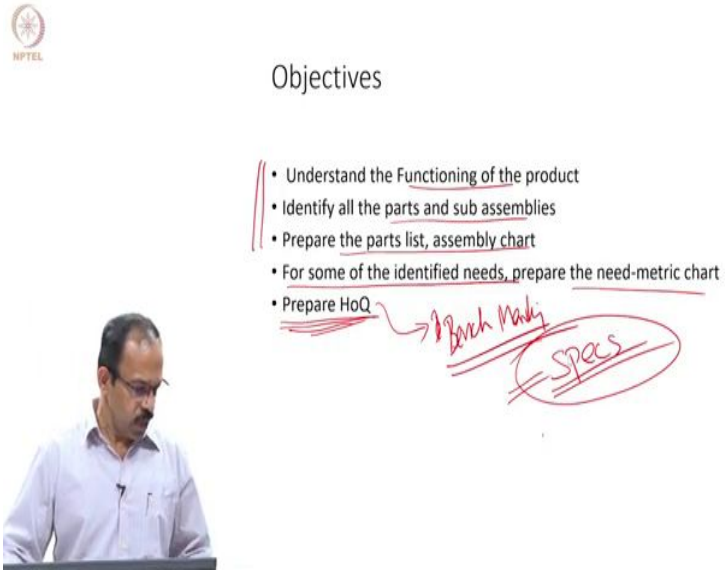

So, the objectives as in the previous cases, the 3 will be the first 3 will be the same functioning of the product, parts, parts list, assembly chart, so, then for some of the identified

needs you prepare the needed metric chart. So, you need to identify the metrics corresponding to each need and then, prepare a need metric chart showing the dependency of these metrics with the needs.

So, what, which are the needs associated with the corresponding metrics and how they are related, whether there is a strong relation or a weak relation need to be identified. So, that is basically the need metric chart, so you need to prepare the need metric chart. And then the next stage is basically to, the next step is to prepare the house of quality and in order to prepare the house of quality, what you need to do is, to identify the give the benchmarking values, get the benchmarking values, from the products which are available in the market as a group you can work on this.

Identify the benchmarking values, and how the products are satisfying the market a currently. What kind of satisfaction they are providing whether they are highly satisfied or less satisfied, can be identified and based on that and their metrics the values of the metric they use. You can identify the target values.

So at the end of this session, you will be getting the metric and the target values that actually becomes the design specification for the product. So, at the end of this need a metric chart and house of quality, you should be able to specify the product or you should be able to get the product specification in terms of the metrics and values.

For example, what should be the weight of the product or what should be the temperature at which it should be heated or what should be the time it should take to get the particular temperature, so those things should be specified and that becomes the design specification for the product. So, this is what is expected from you in analysing this product.

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Okay so, if you look at the product as such you will see that the product is actually the vacuum cleaner and brand is Forbes and the model is Easy Clean.

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And if you look at the major functions you can see in this product, one of the main function is to collect the dust from the surface whether it is a carpet or a floor or a cushion, you need to collect that dust and it is not that just collect dust you need to store it also, you cannot simply throw it out, so you need to have some mechanism to store the dust for which you need to generate vacuum.

So, how do you collect the dust? We need to generate the vacuum. And an additional function that most of the vacuum cleaners will be having is a blowing option that you can actually blow air, so in order to do that you need to generate some pressure and to blow the air. So, these are the main functions that the product is doing.

Now you need to see how the different parts in the product are enabling these functions or supporting these functions, so that is what one needs to do in the exercise. So, the procedure is almost the same as before sessions and here we do not do the functional decomposition for the time being. We will be doing only the house of quality that is what is added in this particular exercise. So, please do the need identification house of quality for this product.

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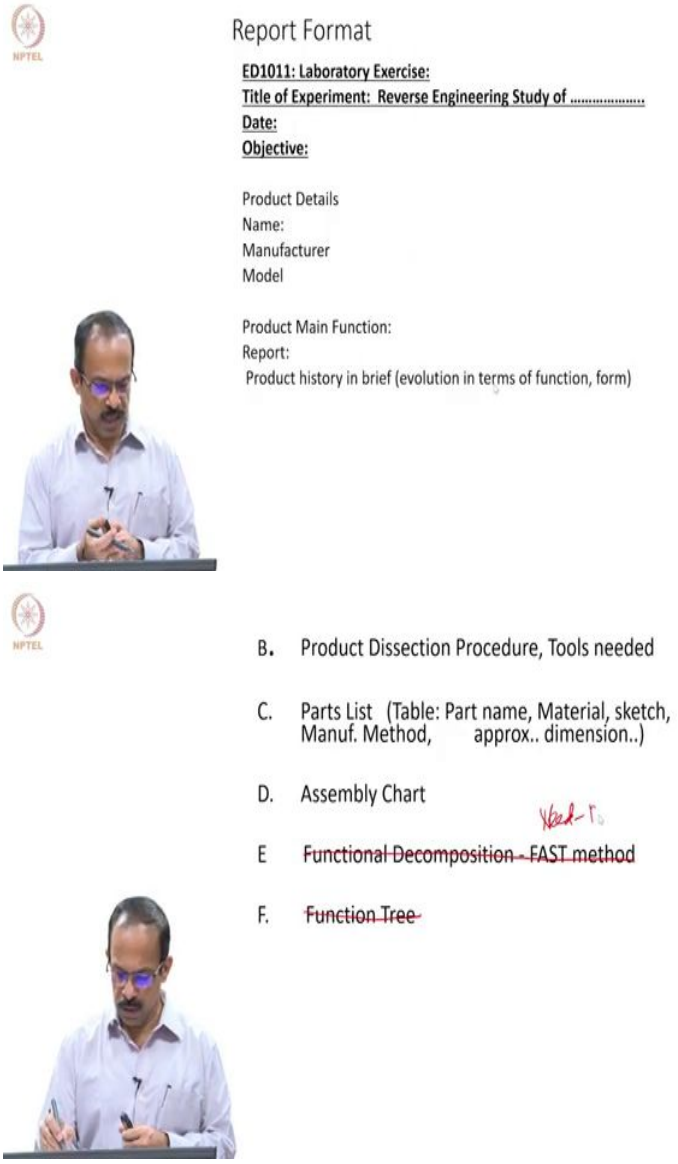

So, this is the format and again as I told you, we will be doing this later, so in this exercise we will be doing the need metric.

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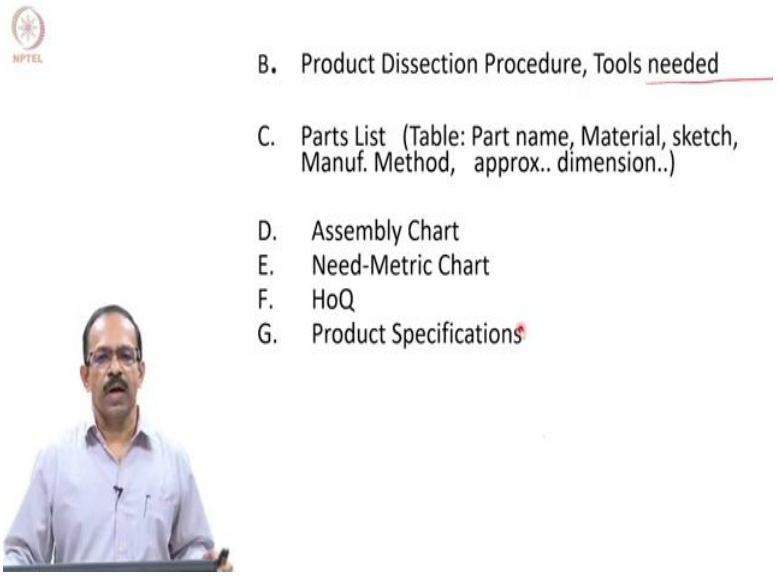

So, as you know we will be doing the product dissection procedure then you have the part list then you have the assembly chart and then this is common for all the reports and after this you will be looking at the needed metric chart. So as I told you, you need to prepare the needed metric chart and then show it in your reports and then you need to have a house of quality.

So, all of you know how to prepare the house of quality diagram, provide all the information whatever is available with you and whatever you can actually, if we are assuming some data, you can actually mention that in the report and prepare the house of quality and based on this specify what the specification for the product is.

So, this is what is expected from you in the report. I hope it is clear to you so, you can go to the technical assistant, he will be helping you with the product and the product dissection and then this part, need a metric chart, house of quality and product specifications to be done by you as a group and then prepare the report and submit. Okay, yes, thank you very much.

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So today we will be looking at a vacuum cleaner. The main purpose of a vacuum cleaner is to clean the households, domestic areas, small households, small places and it is not used for (domestics) like commercial purposes.

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So, the first component that we will be looking at is the brush. So there are various brushes available for different purposes. This one is the crevice brush or corner brush which can be used for cleaning the corners.

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Whereas this is nothing but the extension or the extension hose. This is used for extending the reach of the vacuum cleaner. Suppose you want to reach places where you cannot easily get the vacuum cleaner tool, you can use this to reach that.

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This is nothing but the floor or carpet cleaning brush. The purpose of this is that once you place it on the floor, rub it so the bristles over here will disengage the dust and that will get attracted through this place and that will go inside the vacuum cleaner. So in order to use this we need to use this extension rod, the purpose of this extension rod is similar to the flexible hose just to increase the reach.

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So, another brush that we have got is a posture brush. The purpose of this brush is rather to use for cleaning sofas, cushions, and the bristles. The design of the bristles are such that it can easily remove the dust and that will get attracted through the hole. About the power cord of this product, which connects to the 3-pins socket, the traditional 3-pin socket 230 Volt 50 Hertz and on the other end we have got the on off switch which can be seen over here, and then the other end goes to the motor.

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So, before we dissect this product, there is this additional component you can see. This product is not just a vacuum cleaner it also acts as a blower. So, what you can do is in some places the vacuum cleaner might not be able to create enough suction pressure.

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So, what we do is we use this, remove this component from the back and attach this, so now this vacuum cleaner can be used as a blower. So initially you can see this component which is the rear filter cover. So the purpose of this component is to remove the exhaust gas, the air they get sucked in from here, however when we remove this and put this.

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So, this is nothing but the blower end so now the vacuum cleaner acts as a blower and air gets blown out from this end so this can be used to remove the hard dust that is very sticky on the surface and later on you can easily attract it to the vacuum cleaner. So, that was the purpose of the blower.

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So, the first component over here is nothing but the dust cup, the purpose of this is to attract the dust from this nozzle and store it in this rear, the filter cup. So this is nothing but the dust bag or the dust filter which stores the dust and this is the dust cup.

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Now this is nothing but, the shoulders trap a shoulders trap is basically for easy carrying of the product. So we cannot keep lifting the product for a long time that may cause hand-ache so we can use this shoulder trap for hanging this vacuum cleaner in our shoulders and that will give more comfort.

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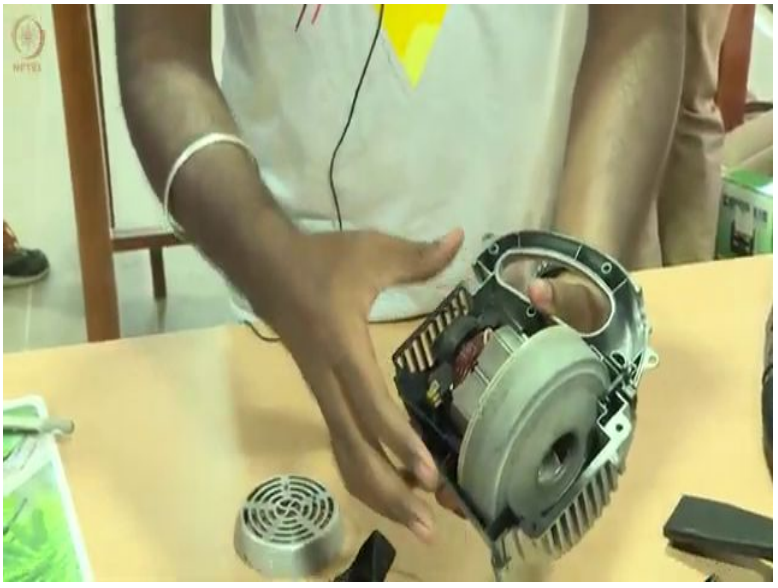

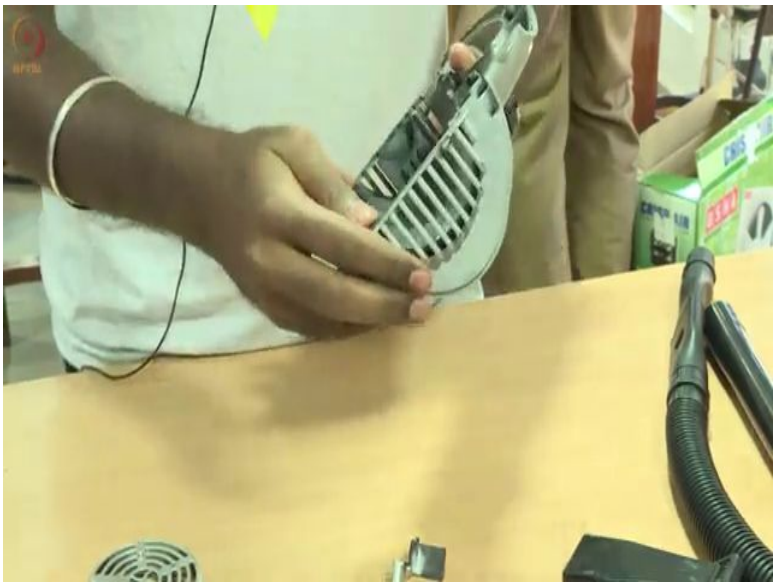

So, this is the main heart of the vacuum cleaner, now this component, the outer component is known as the housing. This is the right housing, this is the left housing. In order to separate it you have just to pull this apart and we can keep it over here, and inside you have got a motor so we will be looking at the motor in a while.

So, we will remove this and give it, the motor generates heat basically. So the design of the housing is such that the heat generated from the motor expels easily. We can look at how the grooves are made, there are projections at a lot of places, so the design has taken the motor heating into consideration before making changes. So, that was the housing, yes one more thing.

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So, this component is the dust cup release button. When you want to pull this part initially, the component, you have to press this button such that this mechanism will come out automatically. Otherwise this is nothing but a snap fit which is basically you just attach it and push it so that it will get go and snapped, get snapped with the housing part.

So, that was the dust cup and this was the dust cup release button.

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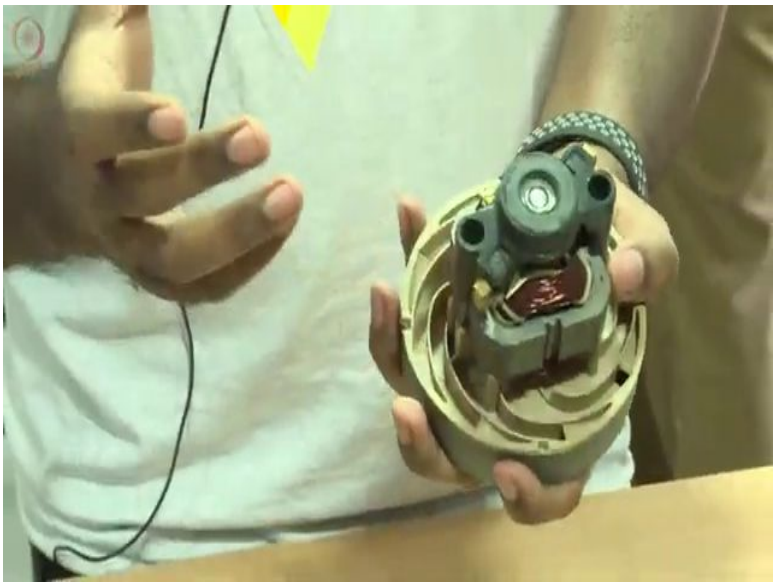

Okay so now we will be looking at the motor. So, before we go to the motor as you can see, this is inside, this is nothing but the impeller. So this looks like a fan and actually it is not a fan, so in a traditional fan, the fin design if you can see the purpose of the fins is to blow air whereas in an impeller the purpose is to create vacuum and because of it air gets sucked in. So, this is the impeller and this is the impeller housing.

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On top of it we have the motor so, this is nothing but the universal motor or also known as the serial motor, so it can work on both AC as well as DC but the input that we will be giving here is AC. So, that is why we have got a laminated stator, so I will be explaining now.

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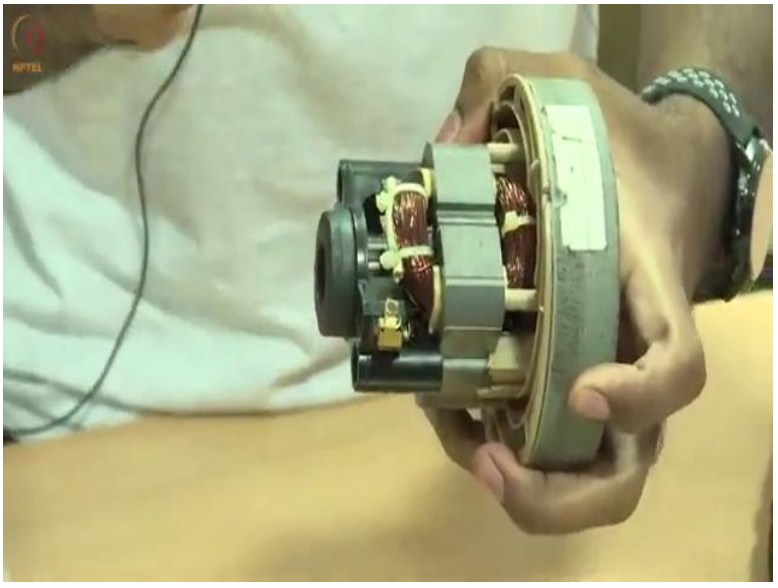

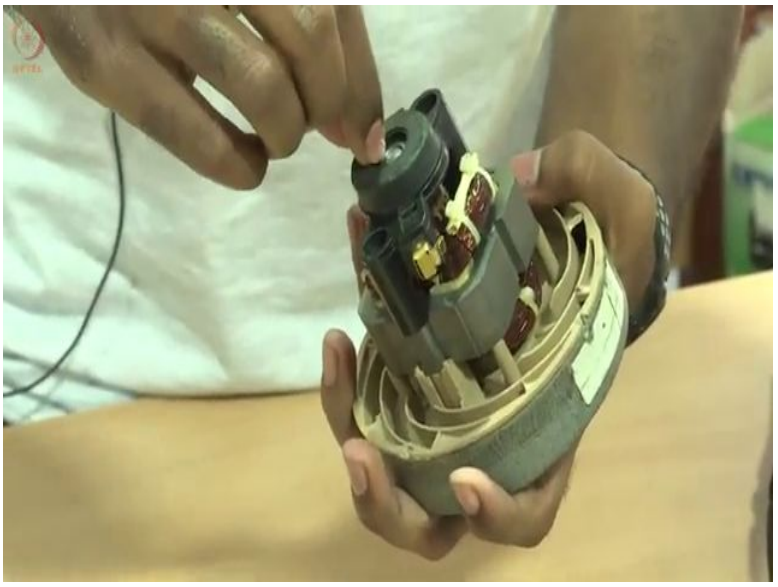

So, this is the stator as you can see this iron part is nothing but the stator. This is the copper winding and these are the commutator and the central part is a rotor which is mounted on this shaft and there is a bearing, so this is nothing but the simple motor and it basically works on Fleming's right hand rule, left hand rule sorry.

So basically how it works is that change in flux generates a force which drives the shaft and that rotates the impeller. So, that is the working of the vacuum cleaner. So, I think we have completed going over the main components of the vacuum cleaner.

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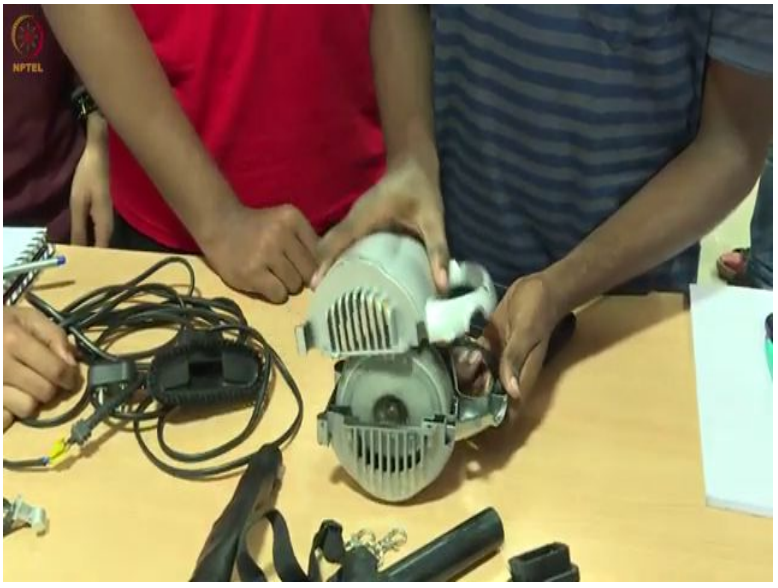

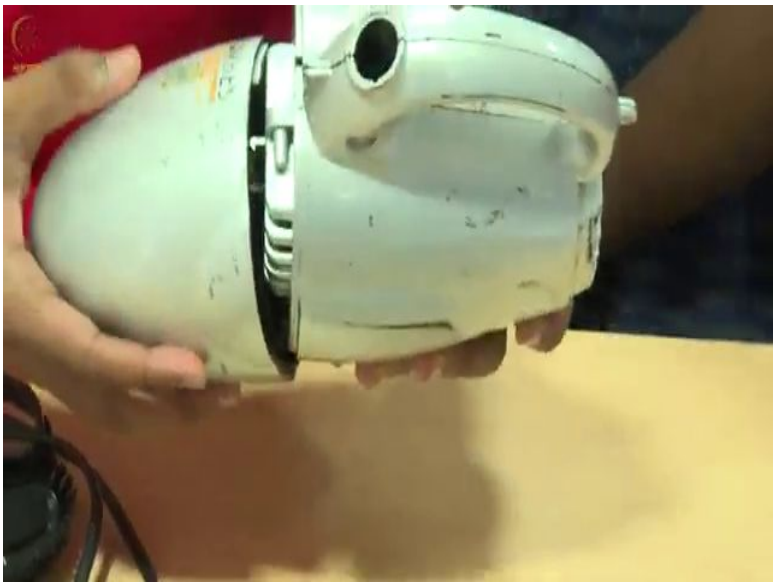

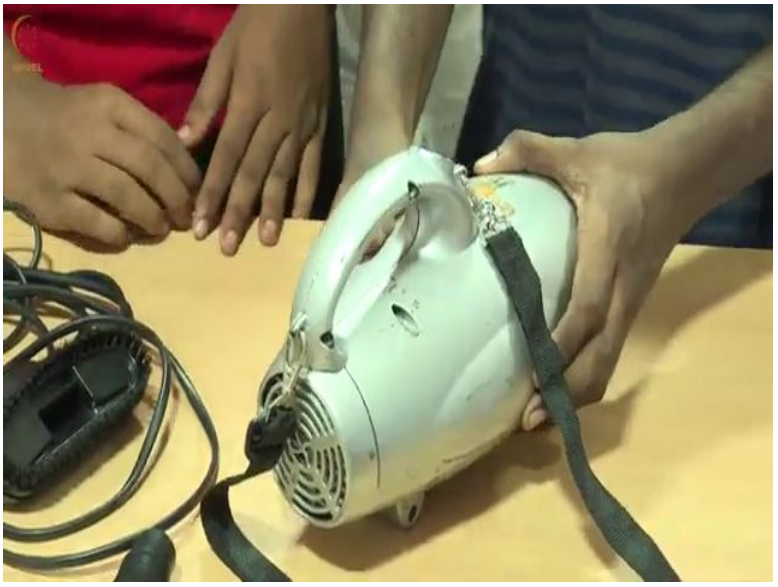

Okay so, this was the product we looked at. It is a vacuum cleaner used for cleaning our households for domestic purposes; there are several types, the evolution of vacuum cleaners happened in the 1800s where people could not be able to clean the dust manually because of the manual effort required. So, the vacuum cleaner was invented.

Initially it was of a larger size, now it has evolved to a compact one now, this product has a some flaws as well for example, even though it is compact it is quite heavy, it is difficult to carry and one more thing in case of power failure we cannot use this product because we need electrical current. So, instead of that we can put rechargeable batteries inside this product which can increase the flexibility as well. And one more thing the product makes quite a bit of noise so, we can put some noise deadening materials to reduce the NBH levels that are being generated by the product. So, that is it.