Organization of Engineering Systems and Human Resources Management
Prof. Vinayshil Gautam
Department of Management
Indian Institute of Technology, Delhi

Module - 2
Effectiveness and Performance
Lecture - 22
Man-Machine Relationship

Any study of a managerial process will require some understanding of the man-machine system, especially so when it comes into an understanding of the engineering business. But as you can sense from my remark, Man-Machine Relationship is not confined just to engineering business. Man-machine relationship is existent even as I talked to you; I am talking to you with the help of a pen drive, a laptop, a projection system, a recording system. And as I talked to you at least four kinds of skills are involved in taking the acts to you, one is the skill of the person, who did up the power point presentation which is projected.

The second is the skill of the person who did the contents, and it is talking to you in designing the presentation, in delivering the presentation. And the skill required in ensuring that you are understanding of the subject matter is complete, and of a certain level which makes it operational. The skill of the person who is supervising the recording of it, and the skill of the person who is actually doing the recording.
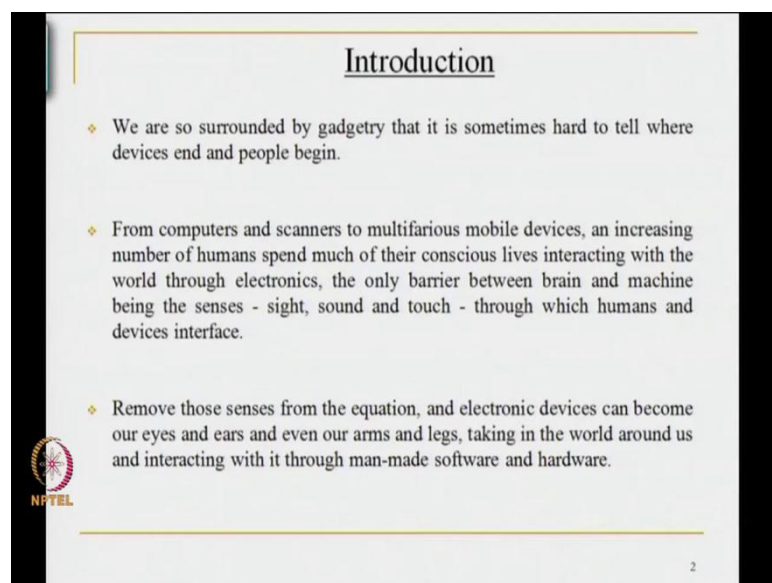
The action does not stop there, the recorded presentation in a storage device will have to be uploaded, and then made available on the website, from where you through the use of another set of sequences of machines, assisted by the skill of another set of people will be able to access it. Perhaps it would not have occurred to you, that there were such an intense series of man-machine relationship, involved in making what is a relatively straight forward presentation on a topic.

But there is also hierarchies of skills, obviously the skill required in formatting a PPT, need not be of the kind of skill required in developing the contents, which interned meant; referencing, selecting, interpreting, looking at the applications, making sure it was relevant to the level of understanding of the listener. That delivering it through a medium, in a manner which was comprehensible, with illustrations, which make it possible to follow the

line of a argument, which will be again be a skill very different for a from a person, skill in supervising the recording, there are certain mechanistic skills.

There are certain professional skills required of a cognitive variety, where depth of the understanding of the subject matter is required, and the illustration can go on, but the larger point is, at each stage you see a man-machine relationship. Therefore, the conclusion to be drawn as, a man-machine relationship is universal, endemic, and has to be understood in its visor connotation.

(Refer Slide Time: 05:20)

Introduction

- We are so surrounded by gadgetry that it is sometimes hard to tell where devices end and people begin.

- From computers and scanners to multifarious mobile devices, an increasing number of humans spend much of their conscious lives interacting with the world through electronics, the only barrier between brain and machine being the senses - sight, sound and touch - through which humans and devices interface.

- Remove those senses from the equation, and electronic devices can become our eyes and ears and even our arms and legs, taking in the world around us and interacting with it through man-made software and hardware.

We are so surrounded by gadgetry that it is sometimes hard to tell where devices and people begin. Now, this is the heart of man-machine relationship. Almost everywhere, from entertainment, to business, to travel, transport, and the illustrations are endless. This needs to be elaborated from computers and scanners, to multi various mobile devices and increasing number of human suspend much of their conscious lives interacting with the world through electronics, through mechanics, through all types of engineering situations.

The only barrier between brain and machine, sometimes being the senses, the senses can be off site, sound, touch, through which humans inter phase the devices. The done thing in electronics today now is the touch screen. Till not so long ago, the touch screen was not known. The significance of this is that each device carries with itself, a certain pressure to carry what can be called keyboard skills. Certain felicity of knowing what command to give, for what command to act and what result to produce, am sure you have noticed

people, who face acquired ness, because they have a mobile on them which they have just acquired.

And at an unusual spot in a group situation the mobile starts ringing, and they do not know how to switch it off. Now, even a basic skill like switching of a mobile can vary from one handset to another, and that skill has to be learnt. Therefore, the era in which we live requires, certain skills which are exclusive to a man-machine relationship, but that is not the only man-machine relationship we are talking about; we are talking of a man-machine relationship in a much wider sense.

We are talking of a man-machine relationship in a sense, where one has to acquire the felicity, and the technical sense of say dealing with the situation, and the environment around a fairness, as typically (( )) and iron and steel industry. Where one has to acquire certain felicity in dealing with an assembly line, in an auto mobile industry; where one is dealing with a certain situation even in a process industry, say like the refinery. So, what is it that, what is seeking to get across to you, man-machine relationship has become endemic to mod living.
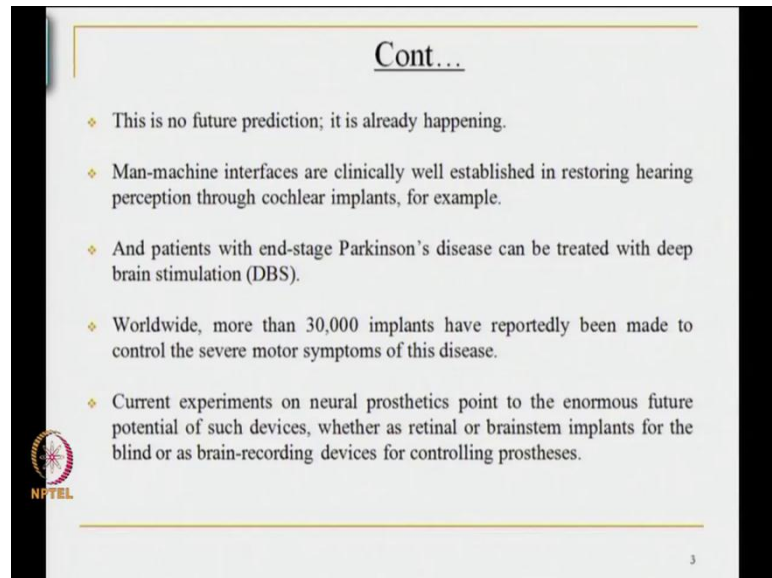
And it therefore, becomes necessary to appreciate and understand, the need for knowing how much of this lives on impact on the other, how much of this is central to the act of getting on with life, how much of this can cause stress, and how much of this requires a behavioral response? The subject is large, and all of it cannot be discussed within the limitations of the time space available to undertake this discussion; however, for all practical purposes one needs to recognize, that one is living in an era, where you remove senses from equations like the ones which you are sited at the beginning of these remarks.

And the electronic devices for one can become our eyes and ears, and even more arms and legs, taking in the world around an intereactery relationship, through manmade software and hardware, this is not just a matter of elements which touch, entertainment or touch automobiles. But can be a huge input to meet in human handicaps of deficient limbs, deficient faculties of sight, acoustics, and more.

So, three things have to be understood, gadgetry by itself can be a means of a continuous demand on human skills, machines themselves, may require a particular type of acclimatization; and perhaps just as significantly man-machine relationship can be a great tool, for meeting the deficiencies of human faculties, human limbs and more. In fact,

speech the future is now, it is happening all around us, man-machine inter phases are clinically well establish, and are tempering perceptions.

(Refer Slide Time: 13:02)

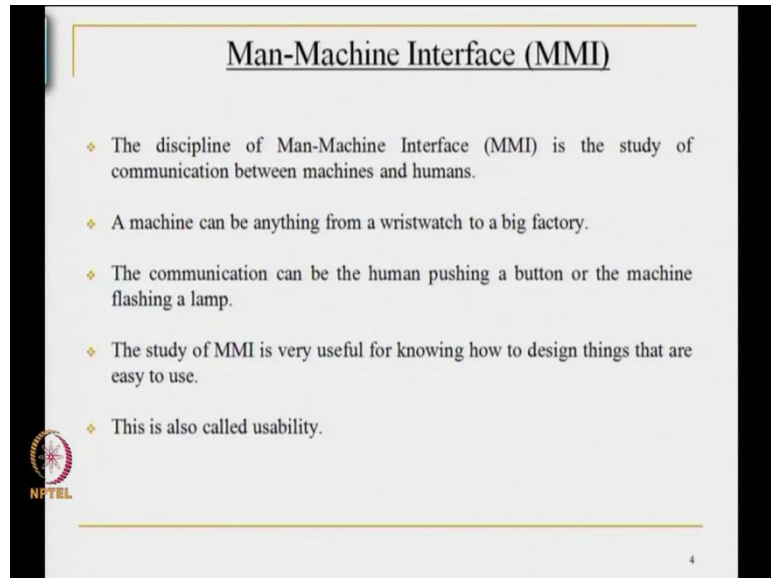
I have already indicated, the deficiencies and impairments of the human body being met through machines what comes easily to mind says, the cockier implants or the kind of aids which are given to those who are visually challenged, but more patients with end stage situation, like saying a Parkinson's disease, can be now treated with deep brain stipulation. In other words, medical electronics has added a yet new dimension to man-machine relationships making machines central to human existence, which earlier onwards confined to reduce in draggery.

But, today helps in making up for impaired faculties, damaged faculties, diseased situations of the human body, and deteriorating bodily conditions. The wonders are large, the examples are at times having mind bugling proportions, if you look at the distortions of the human motor symptoms in a disease, you will understand the vital place of implants of the human body; and that creates yet another layer of man-machine relationship. You would have heard of the in the heart, which strengthens and substitutes some of the heart functions.

And the ongoing experiments in neural prosthetics obviously, open the window for enormous future potential of such devices, whether it be in terms of retinal treatments or indeed through brain, stem implants for the blind, or the brain recording devices for

controlling prosthetics. It may not be possible in each sub segment of man-machine relationship, to elaborate upon it is significance and methods with copying, but it is important to refer to it.

(Refer Slide Time: 16:44)

So, that the issue of man-machine inter phase is understood for its significance, so far as managerial action is concerned; the study of man-machine inter phase, was the beginning of scientific management which was elaborated by Taylor. And from there to the study of organamics, to the study of (( )) reducing interventions of the machine or now pass what we need to remind ourselves is, that the discipline of man-machine interface is the study of communications between machines and humans.

Machines may not be live entities like humans are, but everyone knows that within the artificialities and the boundaries of manmade systems, machines are capable of thinking; there is huge speculation going on today, in scientific fiction of the characteristics of the 5th and 6th generation computers. And the level of communication between humans and machines today, acquire such proportions that by the time that gets robotics, was in one is incline to believe that machines up nearly as capable as human beings, and certainly more thorough because the human errors are not made by machines.

Therefore, a major submission in the study of man-machine relationship is that a machine can be anything, from a wrist watch to a factory, anything which is manmade. Through the principals of technology with predictive futuristic validity, and dependability termed as

machine of some significance to the production process to human life to human existence would have an assumed communication pattern with the user.

I remember once about 35 years ago, going to a shop floor where an elderly supervisor came in, and which his both hands stretched he went down the series of machines, on the shop floor, almost in a full grip. And I could not to begin with understand what he was up to, when I asked he said, he was feeling the heat of the machine, my curiosity further aroused let me to ask and how does that help, he said you do not understand, but machines talk. If the machine is warm or heated beyond what it should be and I can feel it with my palm, it means the machine is telling you that something is going wrong, and it needs to be a tempted for a correction.

And listen to that with wrap attention, felt the machine myself and it took my hand across three machines, and even as a lay person I could see that at least one of the machines was not feeling well, he smiled and he said this is what it is about. Communication aspect between man and machine does not stop there, communication can be with a person pushing a button or a control mechanism flushing a light, after all pushing a button can be called a command or a communication to the machine, for the machine to respond.

And a flushing light on a machine may show a response, and illustrate the point that the machine is now ready for action. The study of man machine relationship is very useful for knowing how to design things, that are safe, that are useful, and that have a longevity, to recover the cost invested in buying them, are easy to use and just as important as any of the factors, easy to maintain. So, this is the usability dimension of a man machine relationship, which has to be understood, before we can get into further niceties.

It can be said that the task of a man machine interaction system, is to make the function of technology self evident to the user, machine acclimatization or machine literacy. Therefore, is an ingredient of the present industrial ethers, and we all need to be machine literate if or nothing else, somewhere at the basic level of efficiency, and safety. We even need to know, how to close the door of a railway carriage, how to lock the door of a car, how to put a electronic lock or why an electronic lock has simple lock, in a manner which is easy to operate, but which is effective, in testing the acumen of a person who is trying to seek an unauthorized (( )).

A well designed man machine interaction fits the user's image of the task he or she will perform; here the technical component of the social technical systems comes prominently in to p. And we move beyond the rather basic understanding of a technology in operation, match it with the sophistication of the operation, of complex equipments, or even the not so complex equipments. And get an imaginary of task accomplishment of a manager, which requires a sensitive awareness of the machine potential, look at the way the cyclostyling machine met it is death, look at the way the telic system was faced out, look at the way the telegraph system has been faced out.

And one has a fair appreciation of how understanding of the machine as a need to human life has become central, do not only human existence, but also if I might add the entire act of running an organization, because there is no other way in which production processes

can continue, or services rendered to human life. In many applications man machine interaction can impact, the overall success or failure of a product. So, there are two things to be noted, first is man machine systems have become central to the act of human existence.

And I have elaborated to you, the possibilities of the machines meeting the deficiencies of the human body, curing the human body, the miracles of machinery in the practice of medical sciences, I have talk to you of the kind of all pervasiveness that electronic systems are assuming in our lives, from entertainment to wrong spot. I have talked to you of the production systems of the through put systems, of a steel plant, and automobile manufacturing operation and I have talked to you different manifestations of equipments, machines, engineering, technology.
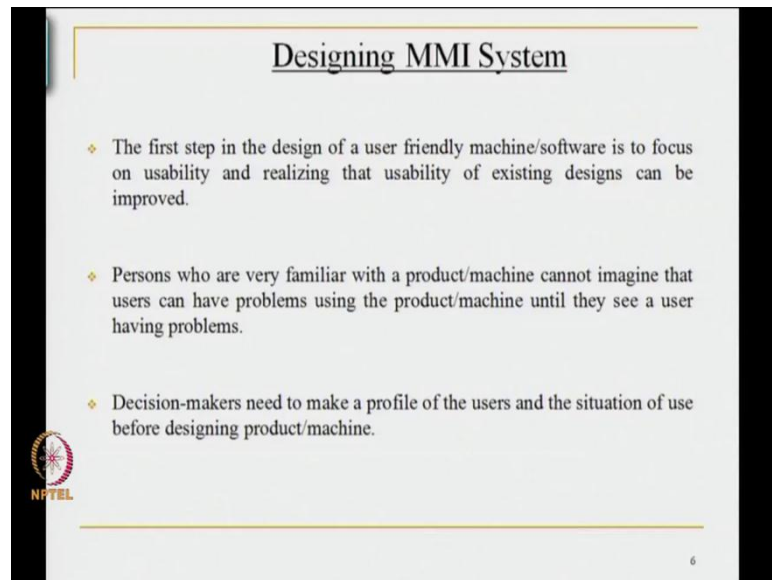
To make it absolutely clear, that man machine relationship is very much an integral part of human production process, of human service processes, and indeed of human life itself; in managerial terms, in terms of engineering business operations, in terms of operations of production purposes. In many applications man machine interaction can impact the success or failure of a product, it has to do with different types of equipment, digital another wise, in different types of assembly lined situations, and the examples of far to well known to merit reputation here.

Therefore, it would be the interest of everyone involved in man machine interaction design, which would cover engineers, management consultants, indeed industrial designers to meet the defined usability requirements, for a man machine interaction system. The defined usability requirements, for specific man machine interactive systems, have to keep in factor several elements, beginning from safety to touching upon upscale ability. A well designed human machine interaction system goes beyond control functions, and provides an operator which intuitive active functions to perform; feedback on the results of those actions, and information on systems performance.

I think this sentence would bear reputation, because it captures one of the basic truth of man machine systems, which are central to the purposes which we are seeking to achieve, through this presentation. And I would like to repeat, a well designed human machine interaction systems, goes beyond the control functions which of course, it fulfills and provides an operator with intuitive active functions to perform.

It requires an operator to have intuitive active functions to perform, provide feedback on the results of those actions, as well as information on the systems performance, quite simply therefore, man machine interaction is one of the central building blocks of production, and service oriented organizations.

(Refer Slide Time: 33:33)

In talking of designing a man machine interaction system, the first step in the design of user friendly machine software is to focus on usability, repeat usability, and realizing the usability of existing designs can be improved. So, focusing on usability is suppose to have an after effect continuing with the usability, and that is continuous improvement of the existing design. In fact, it is one of the truisms of human life, that persons who are very familiar with a product or a machine, cannot imagine that the user can have problems using product of the machine.
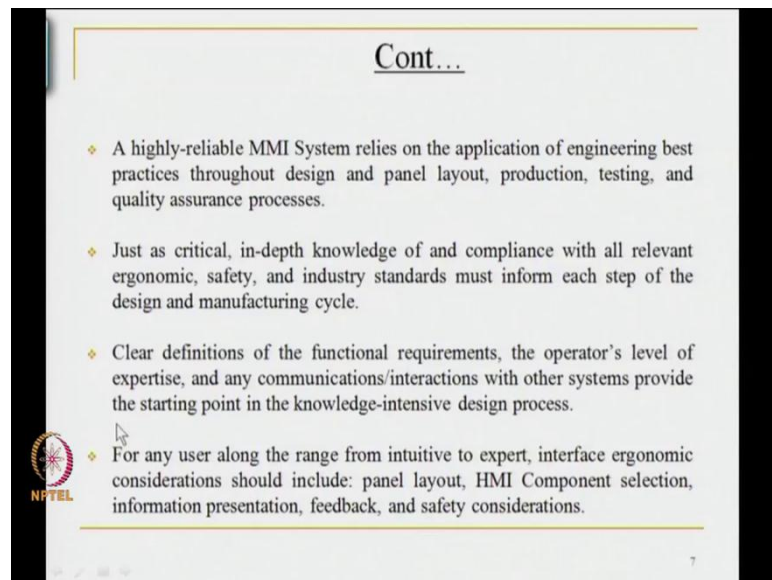
A classical example is the use of the computer, where a bar is not a place to drink, and a cookie is not a product to eat, and when you scroll you are doing something which you did not know, the word scroll could ever mean. In fact, about a decade ago, I had developed a glossary of all the terms which surface on a computer screen, when you give a command and it misfires for some reason, and then very helpfully the computer comes out with a solution. And in following the steps of the solution, you are almost as much at the sea, as you would be at the edges of an ocean, I took the list to a person who had claimed expertise on information systems.

And I looked at the list he winced, he looked at me and he said where you got this list from, to which I said I did not get the list from anywhere, I have created the list from my encounters with the computers, and with essence of helplessness I thought, I would seek their expertise of a person such as you. To which he said in a sort of respect, doctor you want me to tell you the truth and I said how else can it be, he said I am not myself sure of all the meanings of all the words here, the reason is simple I am not a technician, I am an engineer of software, and computer systems.

I said, yes yes I pretended to understand every bit of what he was saying, and I said the difference between a technician, and a software engineer of your excellence is the same distinction, between an electrician and an electrical engineer. The electrical engineer may know how electricity is produced, but he may not be able to fix a switch which has gone wonky, he said of course, you have understood the point and I closed the conversation, and as I came back to the desk.

I can tell you that of the list which I created then 1 3rd of it is still alive, and indeed more have been added to it, because the system kept graduating from Pentium 1 to Pentium 2 to Pentium 3. And what have you, and the persons, who are familiar with the product of the machine, could not understand what people of my description need to be told, to be able to use the product or the machine in a trouble free, and wise the popular phrase goes in a user friendly manner, that problem still exists. The decision breakers need to make a profile of the users, and the situation of use before designing the product or the machine, if it is happening well then the incidents of it needs to be multiplied many fore.

A highly reliable man machine interaction systems, relies on the application of engineering best practices, throughout the design, and panel layout, production, testing, and quality assurance processes. You know the words the larger point which I am trying to put across to you is, that to create a man machine interactive system, that focuses on the application of engineering, begins much before, the machine is actually put out into the market, it has to come in at the time of design, at the time of the panel layout during the production phase, and during the testing phase.

Unless you begin there, using and equipment, using a product which has been put out in the market what forever be problematic, and if I might say so frustrating, for a person who pays hoping for the service, and then comes to the conclusion, that he is some a illiterate, in the use of the equipment, use of that machine. Because as you look around, you hardly find any facilitation of people offering to help you to know, how to use a machine or how to use a product, and that is only one aspect of the story.
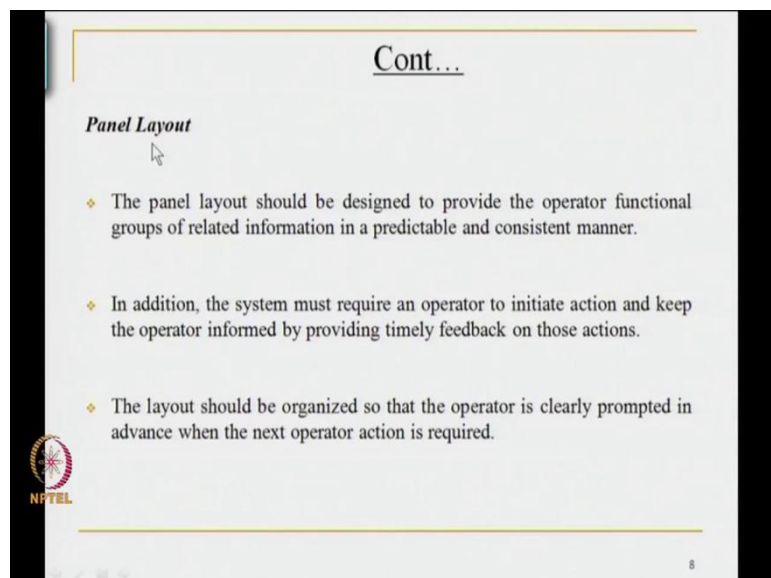
Clear definitions of the functional requirements, clear definitions of the functional requirements the operators level of expertise; and any communication in interactions with other systems provides the starting point in knowledge intensive design processes. I consider this a very important thought, and I would wish you to all over this, to repeat clear definition of the functional requirements, the operators level of expertise, and any communication interaction with other systems provides the starting point in the knowledge

intensive design program. The please therefore, why just dealing with engineering systems, but dealing with entire process of designing, developing, testing, marketing of machines.

One should be focused on the functional requirements, and above all the operators level of expertise, in the ultimate analysis it is the operators level of expertise, which will determine. The quality of the results, of the efforts through the machine, the acceptability of the machine, the longevity of the machine and much that goes along with it, for any user along the range, from intuitive to expert, I repeat for any user along the range from intuitive to expert, interface ergonomic considerations should include the following panel layout.

And let me repeat, before the elaboration of the components the taught, that for any user along the range from intuitive to expert, interface ergonomic considerations should include panel layout, human machine interaction components, selection information presentation, feedback and safety considerations. One of the legitimate expectations from the study of man machine interface would be to produce more useable safe, and long lasting machine utilization patterns.
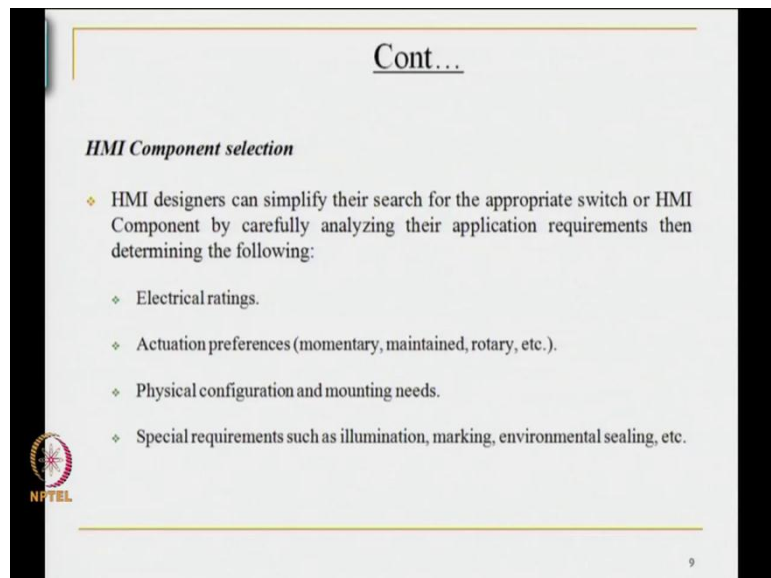
(Refer Slide Time: 44:56)

What is the significance, therefore for this elaboration, so far as panel layout is concerned; the panel layout should be designed to provide the operator, functional groups of related information in a predictable and consistent manner. And now talking of the production

systems, which cannot possibly behind it, unless the work begins at a panel level, the work begins at the design level, and the operator is kept as a touch stone, where an operators functional groups of related information in a predictable and consistent manner is the touch stone.

In addition the system must require an operator to initiate action, and keep the process informed for providing timely feedback all those actions. In other words, if you look just at the machine, as a part of the production process moving far away from the packaged equipment, to which we were referring from the presentation began, the operators role function should be designed in the machine function in a manner, in which the experiences of the operator.

And his reactions to the way the machine is working, can be provided in a timely feedback on those actions to were it matters, the lay out should be organized, so that the operator is clearly prompted in advance, when the next operator action is required. The layout should be organized, so that the operator is clearly prompted in advance, when the next operator action is required, it is like amounting a simulated car which propels itself on the slope of a gondola.

(Refer Slide Time: 48:26)

Say typically in some of the countries of the southern hemisphere, as an entertainment of a joyful exercise and the car moves so fast, that it is made to pause for a few seconds, and unless you are alerted about the next movement of the car, to follow as you sit into the car.

You may take that (( )) 5 seconds longer and the car moves, and you may trip up to put it simply therefore, the layout should be organized, so that the operator is clearly prompted in advance of the next operator action that is required.

To move the discussion forward, it had discussed it has implications, for the human machine interaction component selection. And that is something which we are going to take up as a follow up discussion, to follow in an integrated manner with the discussion of the color scheme, with the discussion of the information presentation, with discussion of the user feedback, and indeed examples of the usability problems.

Therefore to create a package which will be contused to you learning, in the sections to follow after having discuss with you panel layout. I am going to take up human machine interaction component, followed by color scheme, followed by information presentation, followed by user feedback, and examples which will help you to understand what the actual human machine relationships is all about.