Design and Implementation of Human – Computer Interfaces

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Module No # 01
Lecture No # 01
Interactive Systems

Hello and welcome to the NPTEL MOOC's course on design and implementation of human computer interfaces. Today we are going to start the course with the first topic that is general introduction to the interactive systems and brief history. Before we begin let us understand the scope of this course. So here we are going to talk about design and implementation of interactive systems.

In other words we will be actually talking about how to engineer quote unquote engineer and interactive system.

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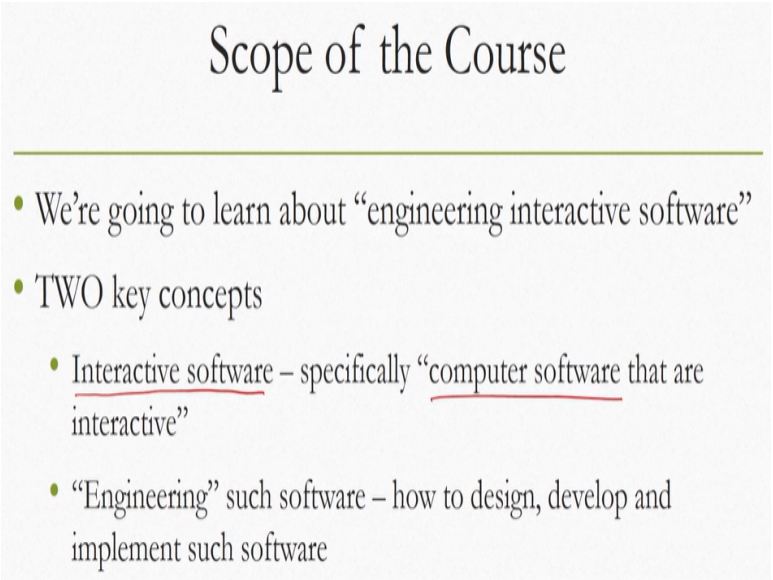

So there are 2 things involved here one is interactive system or software specifically computer software that are interactive. So we are going to focus here entirely on software that is interactive what is interactive software? We will soon learn about those second concepts that are important here is that word engineering. So here we actually refer to the fact that such software can be developed in a very systematic manner involving stages and we are going to learn about those stages.

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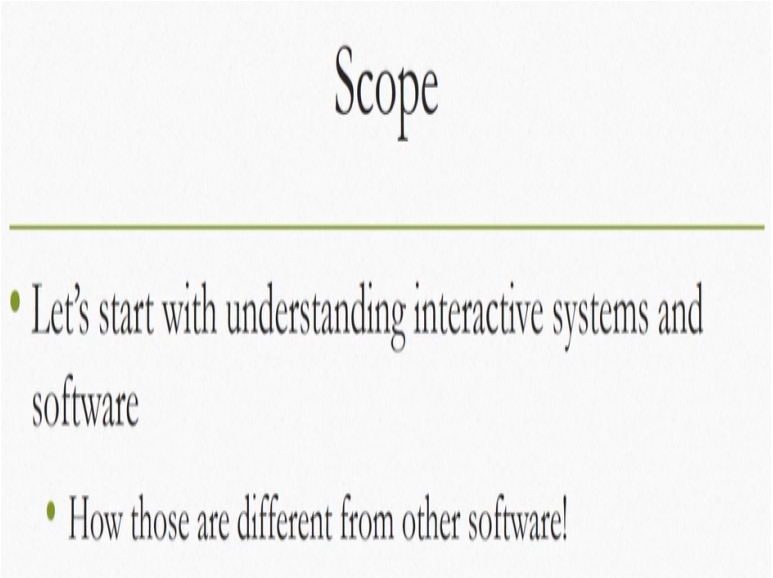

Given this scope of the course let us being with the major the primary concept that is involved here that; is interactive software or interactive system. In general where we will be implicitly referring to software whenever we; are going to use the term interactive system. Now these interactive systems whenever we mention this term automatically questions comes to mind why we are labeling certain software's as interactive and how these are different from other software.

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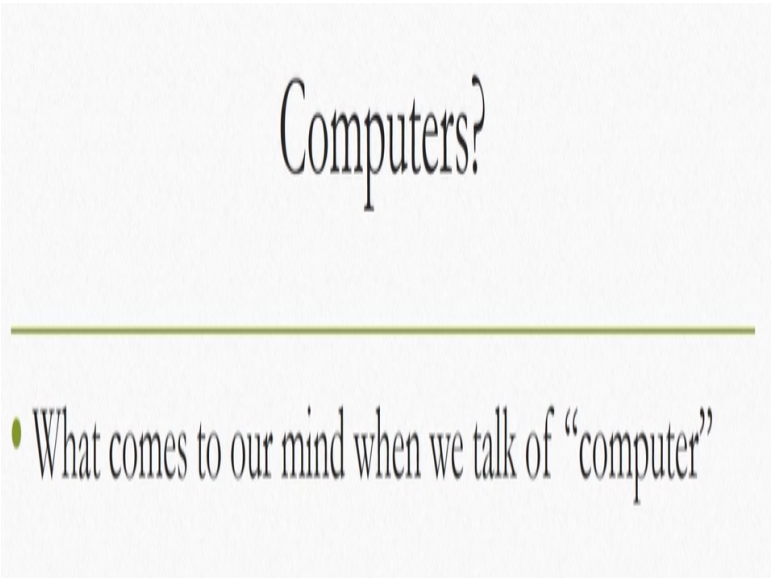

Let us try to understand that little bit in depth so let us begin with the very concept of computer why never we mention the term computer? What comes to our mind?

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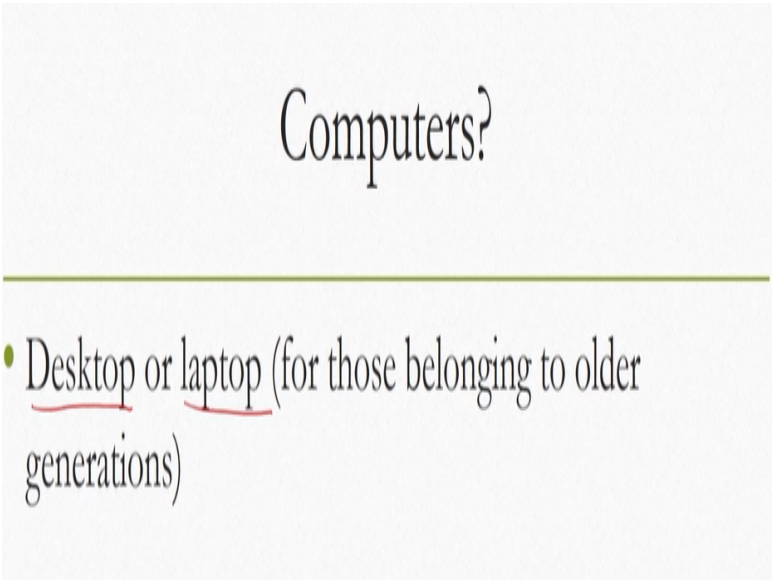

For those who are part of an earlier generation the term computer immediately brings to mind desktop or Laptops most likely.

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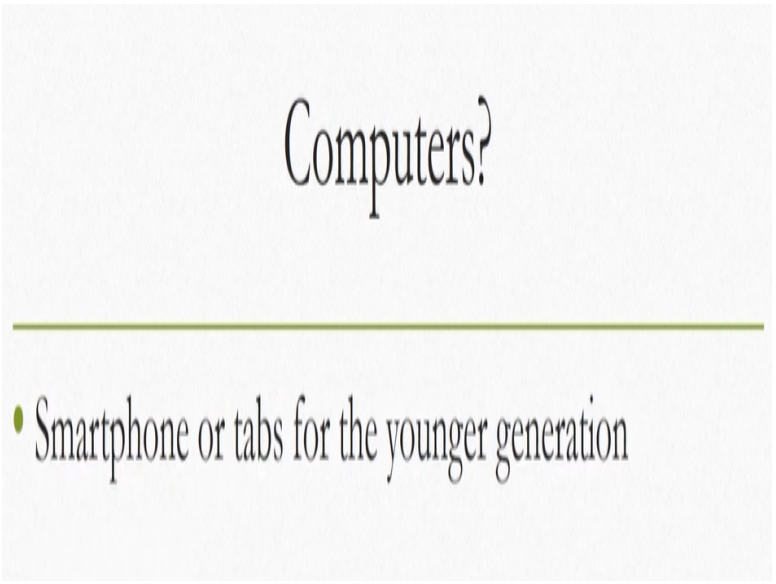

For younger generation the term computer may also refer to along with desktop and laptop may also refer to smart phones or tabs or even some wire able devices.

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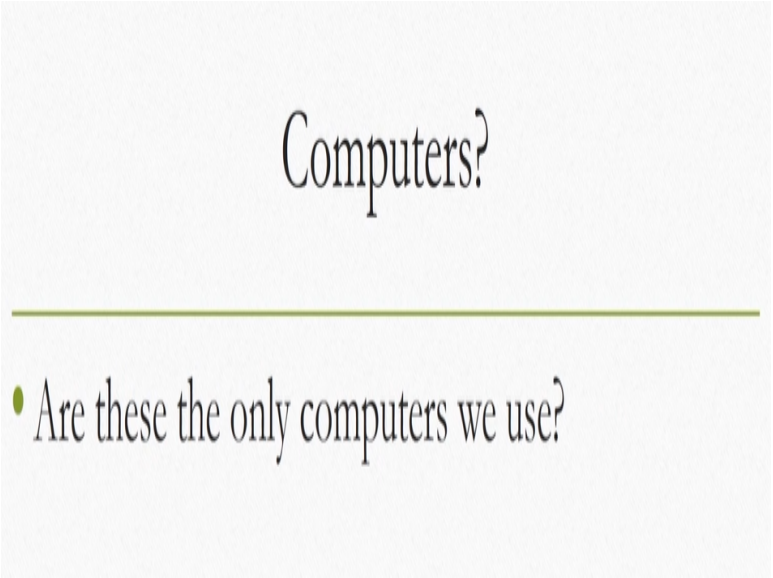

Now this desktop, laptop, Smartphone, tabs are those only the examples of computer let us see.

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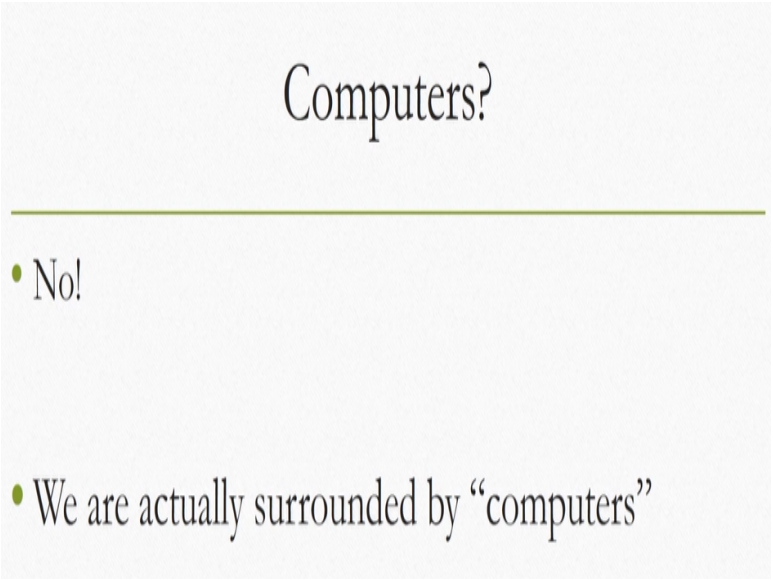

The answer is unequivocal no there are many more computers that we may be using without being aware of them.

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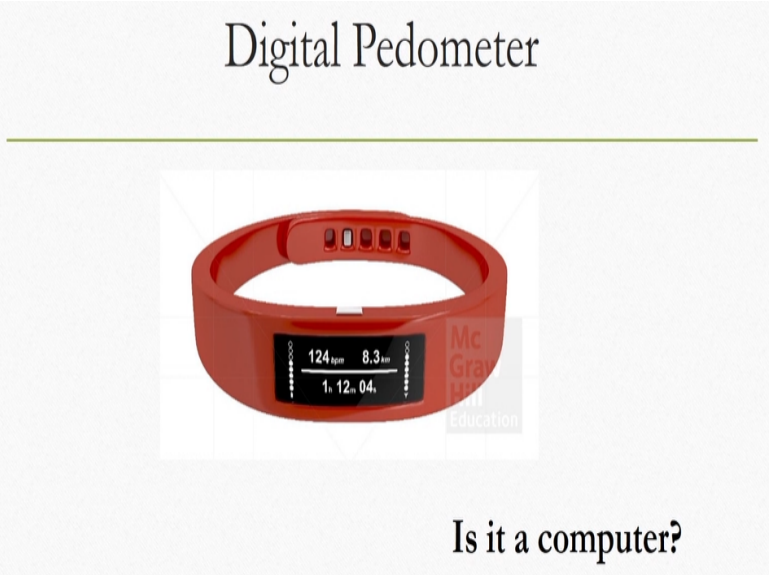

In fact we are surrounded by such computers let us see one simple example a digital Pedometer. Is it a computer? To understand this question or to answer this question let us first go with the definition of a computer. What is a computer?

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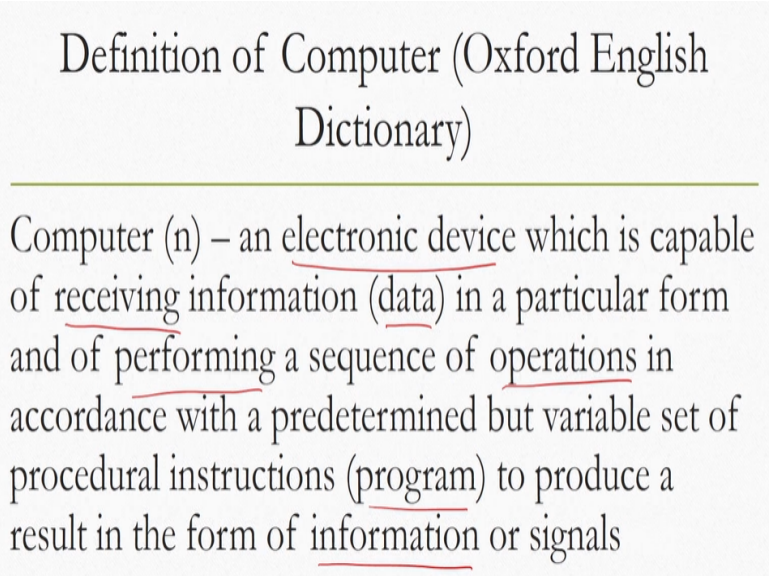

According to oxford English dictionary a computer is an electronic device which is capable of receiving information data in a particular form and of performing a sequence of operations. In accordance with a predetermined but variable set of procedural instructions which is also known; as program to produce a result in the form of information or signal. So in a nutshell a computer take some input apply some program to convert it to some output and the program performs some operations on this input and this program is pre-stored somewhere.

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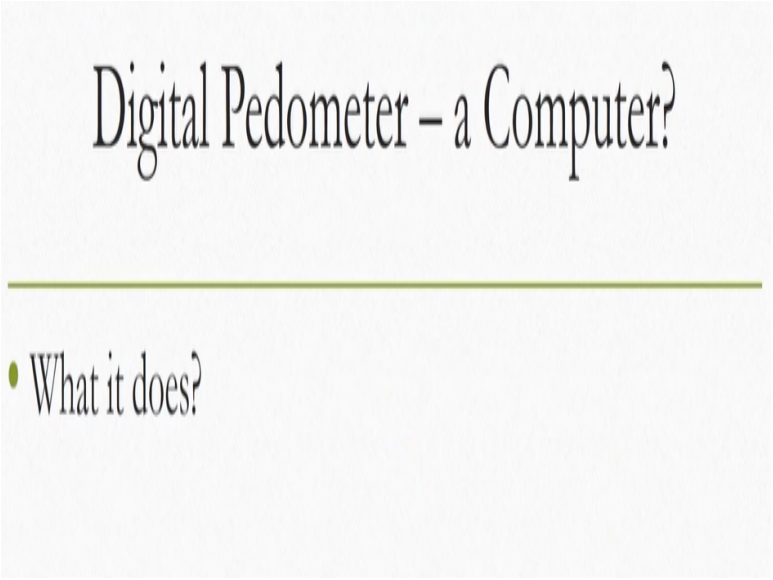

Now let us comeback to digital Pedometer whether it is a computer or not. So what a Pedometer does?

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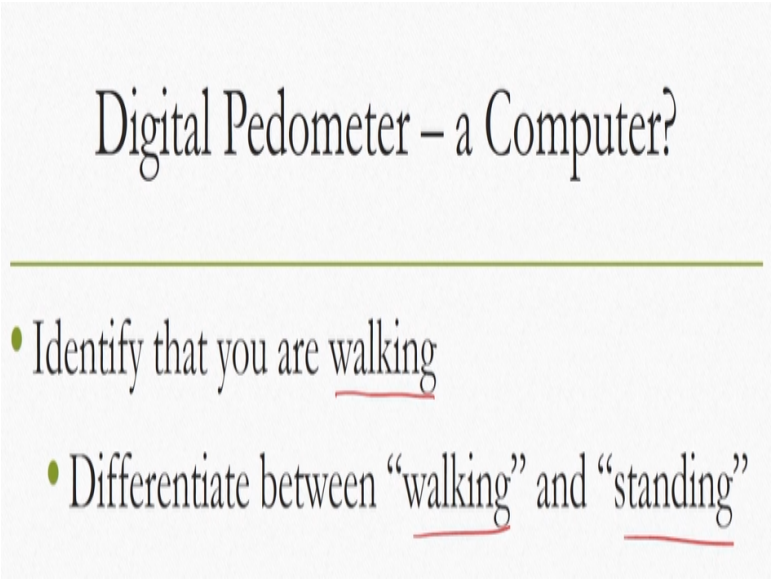

The main objective of a Pedometer is to identify that the wearer is working or not? Of course now a day's Pedometer also have many features but let us only focus on the key function of a digital Pedometer which is trying to determine the walking speed and the walking distance. So essentially it tries to identify whether you are walking or not. So in order to do that; it must differentiate between walking and standing how a device can do that?

When we are trying to do it we visually see the movement and then accordingly our brain produces the understanding whether somebody is standing or walking. But in that case of a digital pedometer how it can do that?

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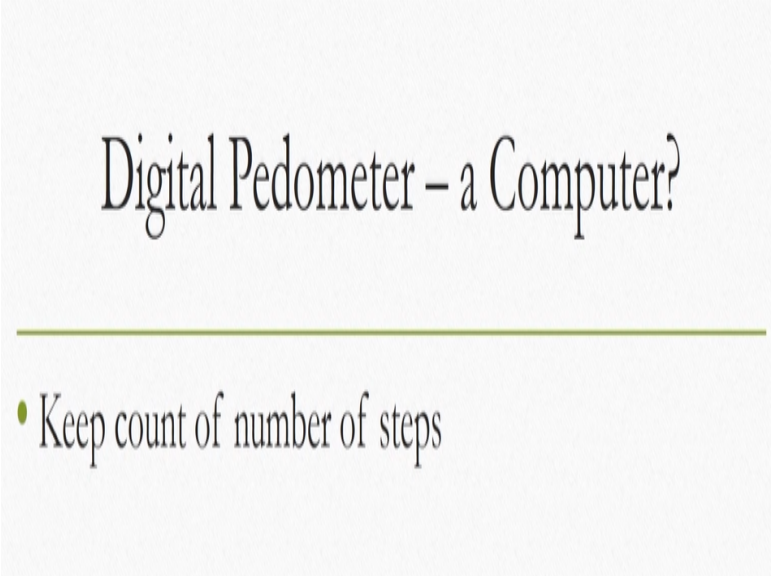

That is one issue second issue is typically digital pedometers are known to keep count of number of steps.

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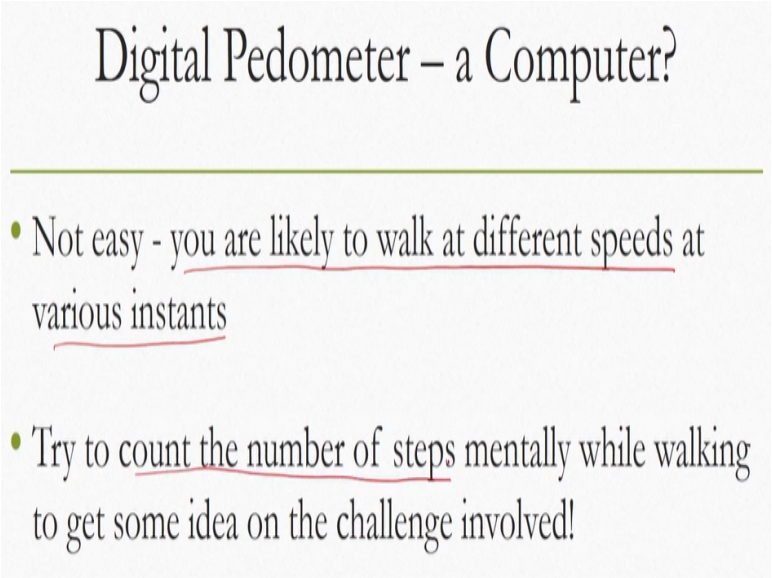

So that is another function but as you may understand or as you may try to understand counting the number of steps is not an easy task. Because you are likely to walk at different steps at various instance of time in fact as a though exercise you can yourself try to do it try to count the number of steps that you are performing while walking. And you will understand the difficulty involved.

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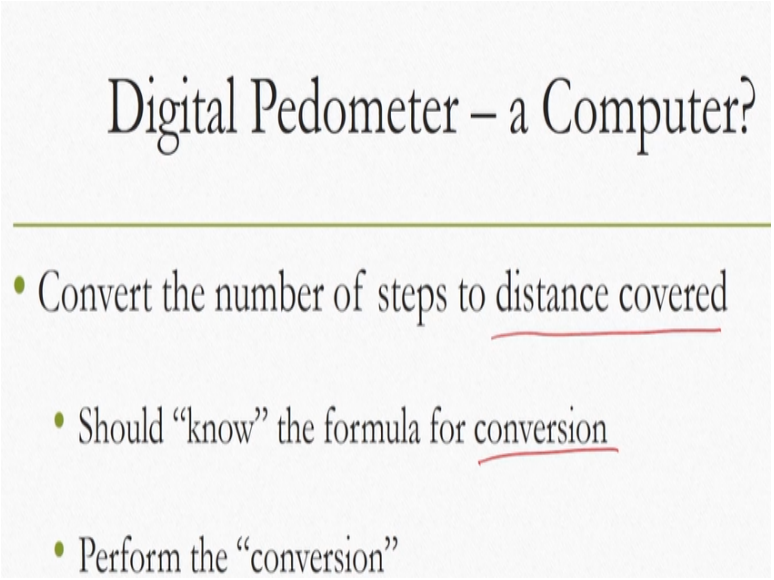

So the pedometer first tries to understand that you are walking then it try to count the steps the number of steps. And finally from the number of steps it tries to compute the total distance covered. So how it does that? It has to know some formula for this conversion and based on that formula it can perform the conversion so, this formula as to be somewhere in the device.

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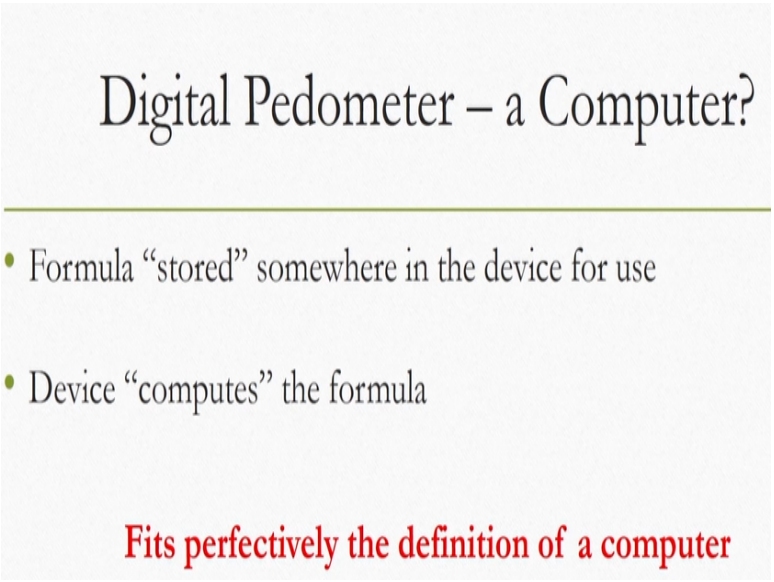

So there are 2 things involved one is trying to understand whether you are walking then counting the steps and then converting it to a distance and the second thing is storing the relevant formally as well as performing the actual computers. So if we now try to compare the activities of a pedometer with the definition of a computer we will see that pedometer accepts as input.

Some sensor information processes it based on the algorithm which is nothing but those set of formulae. And based on that algorithm it produces some output which is the distance covered or the walking speed etc. So it perfectly fits the definition of a computer so digital pedometer we can say is a computer.

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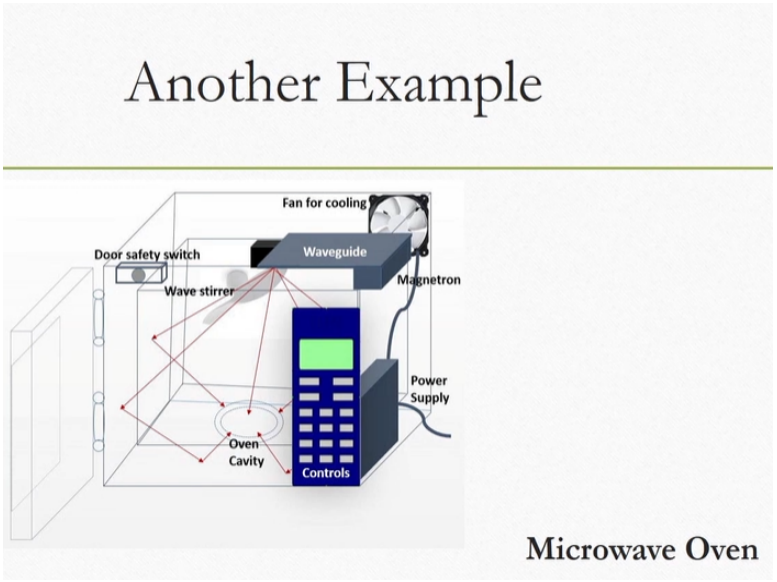

Let us see another example microwave oven many of us might have seen this in our kitchen. So is it a computer?

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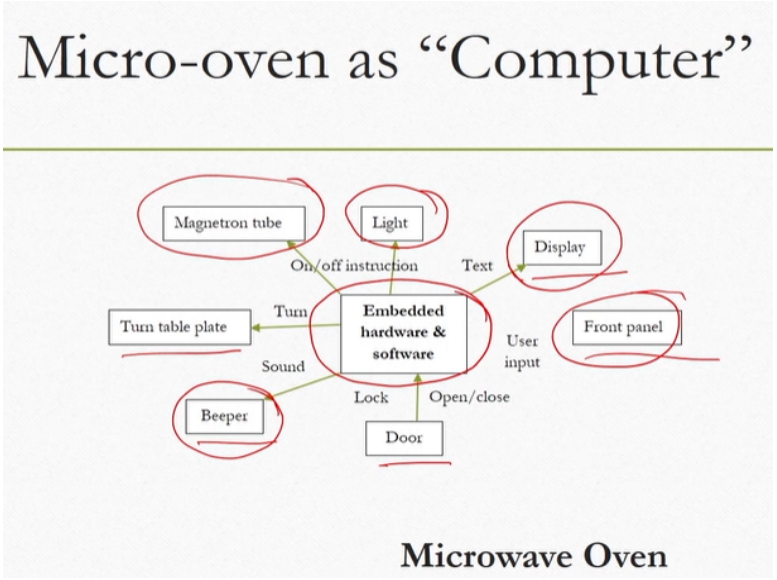

Now if we look inside the oven we will see that it consist of various components broadly these are the components who are likely to find inside a microwave oven. A magnetron tube, turn table plate, beeper, door, front panel, display and light these are the components. And

then there is some embedded hardware and software to operate these peripheral devices. As well as generate certain output those devices.

So here also we can see that it receives some input say for example input from this front panel in terms of the temperature duration. Then it produces some output on the display as well as some sound output and it performs certain operations depending on the input provided based on stored program. So it also is an example of a computer as per definition.

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A third example is a smart TV whether it can be considered as a computer or not.

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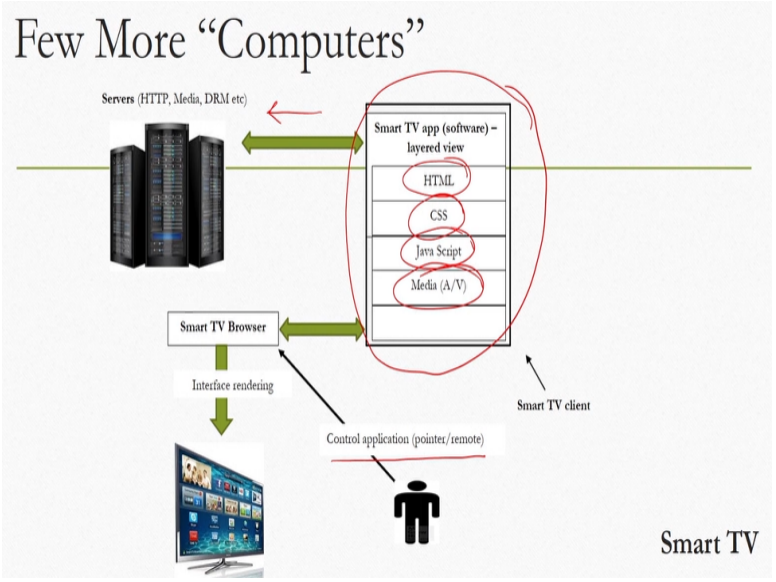

Here also there are lots of components involved let us have a look at the software or the smart TV app which can be understood in terms of layered view of the software where you have

HTML, CSS, Javascript layer, media layer and on so and so forth. So the user provides some input to the app through some interface then the TV itself has the software which is connected to some servers to fetch information.

And then that information is processed and displayed on the screen again it takes input processes based on the stored program and produces output. So as per definition this also is a computer so these examples so that we are surrounded by computers.

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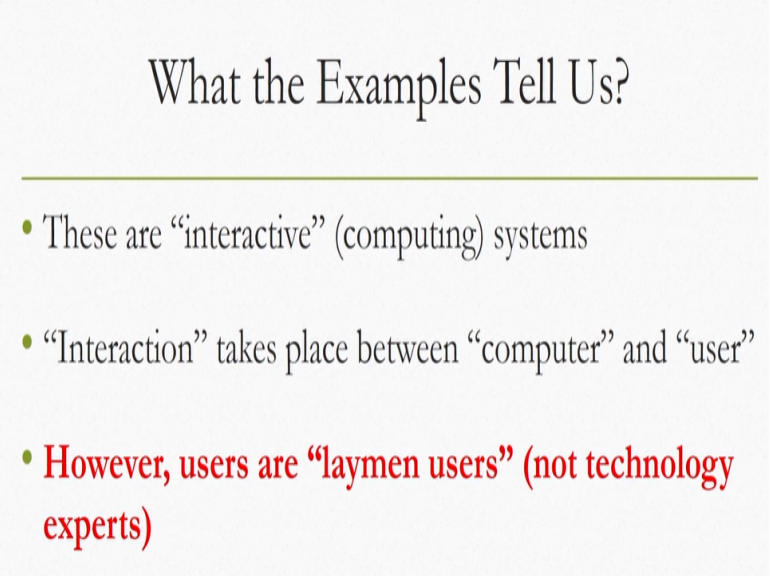

Now all these are actually examples of interactive computing systems and the interaction takes place between the computer and the user. Now the most important factor is that these users are not experts, these users are layman users. Anybody can be the user of the digital pedometer or microwave oven or a smart TV without any specific qualification. So that is the defining characteristic of any interactive system or interactive software or interactive computing system.

That these are systems that are used or interacted with by a user is a layman user who does not have any specific qualification to be a user of the system. So whenever we will be using the term interactive system will be referring to such systems where layman users are the users of the system rather than somebody who has special training to use the system.

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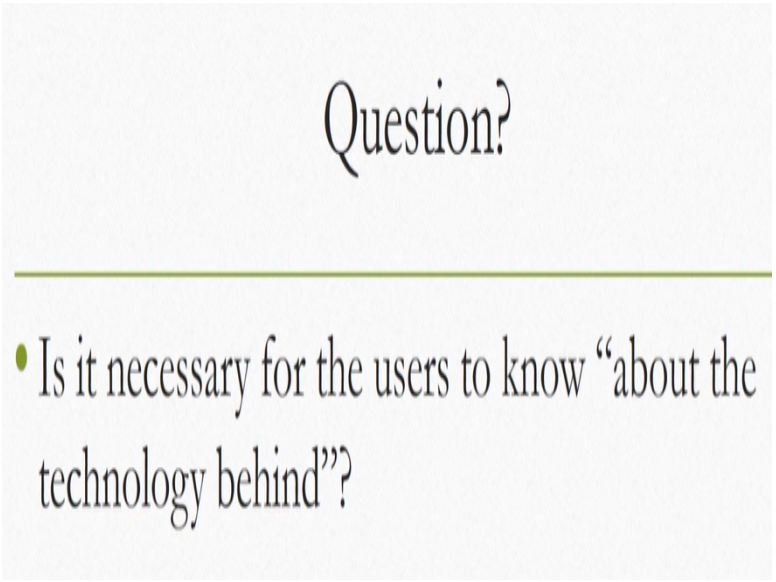

Now this brings us to the next question that we should try to answer is it necessary for the users to know about the technology behind. So I said that for an interactive system users need not have any specific qualification. In that case to operate or interact with an interactive system does, the user need to have any specific technological knowledge.

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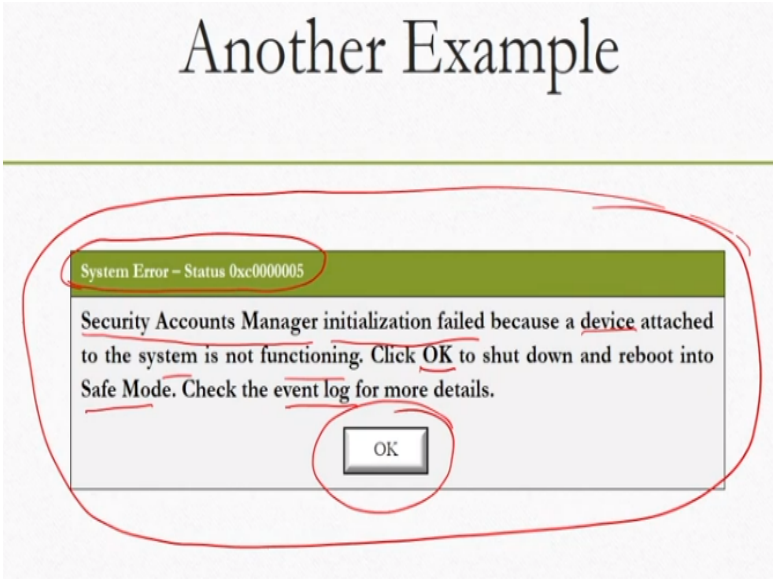

Let us see another example some of you may by familiar with this type of display. It used to come in some earlier operating system, version where they are used to some error messages displayed in this form. So this is actually an example of an error message produced by an operating system which used to be there same time ago what it says that? There is a header which says system error status some number which is actually in hexadecimal code.

And then what it says is that a particular system, a particular app or application initialization failed because some device attach to the system is not functioning click ok to shut down and reboot into safe mode. Check the event log for more details and there is only one button to select which is okay. So whether you like it or not you have to press ok to move forward now what this message actually tells us.

If I do not know anything about this terms or what is the hexadecimal code what is event log? What is system accounts manager or security accounts manager? I will not understand anything from this message although it is shown to user of the system but the user is expected to have certain level of knowledge as is evident from particular output.

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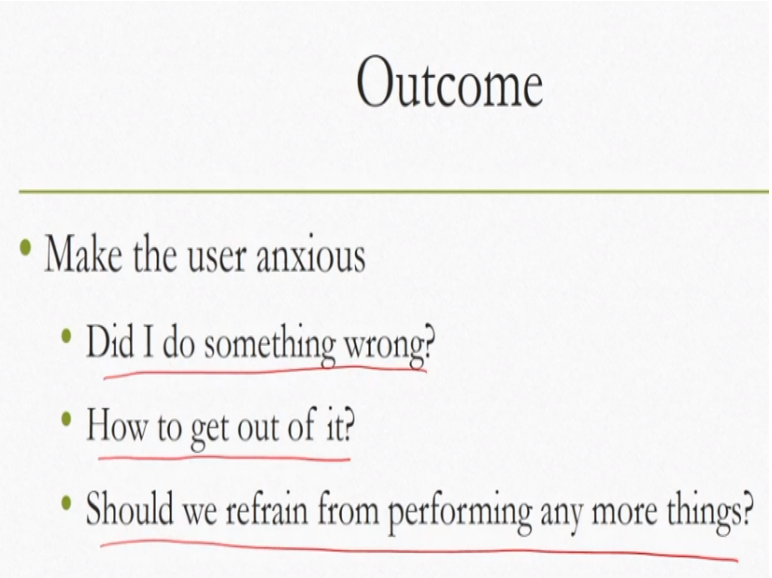

Now if I do not have that knowledge then I am not going to able to figure out what is that error and what I am suppose to do. So that will lead me as a user to anxiety. Did I do something wrong what is that wrong thing I did? How to get out of it? And should we refrain from performing anymore thing so that such error messages do not come again and again. That is anxiety that I will have if I do not know the meaning of those messages.

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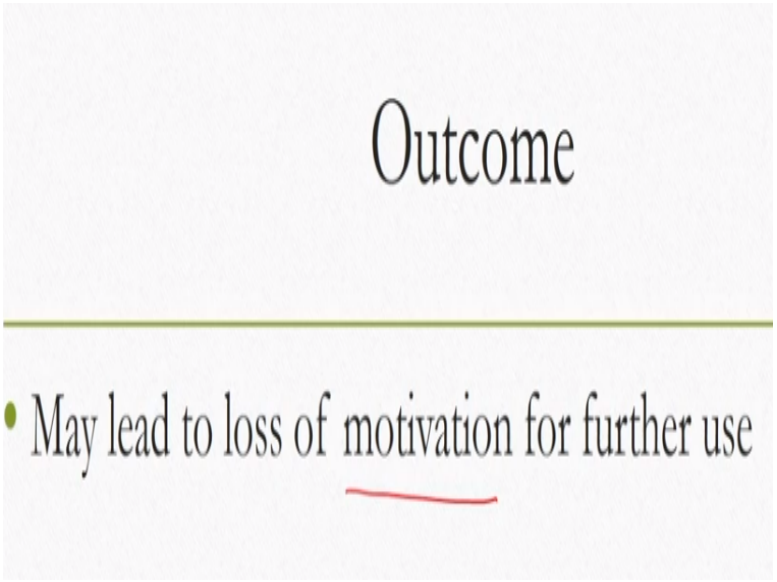

Now this anxiety or this kind of confusions in the mind of the user may lead to the loss of motivation which is very important loss of motivation of further use. In effect this will make the user think that such systems are not for me to use. So rather I should not use it which actually will defeat the whole purpose of making the system used by the users.

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So these concerns where we want to avoid the user being forced to lose to motivation or being forced to have confusion because certain knowledge is not there. This concern actually brings us to these important concepts of user centric design.

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The principle objective for interactive system should be that the system should not force users to learn about the underlying the technology that should be the guiding principle for any

interactive system otherwise the user will not be motivated to use the system. So accordingly the system should be designed.

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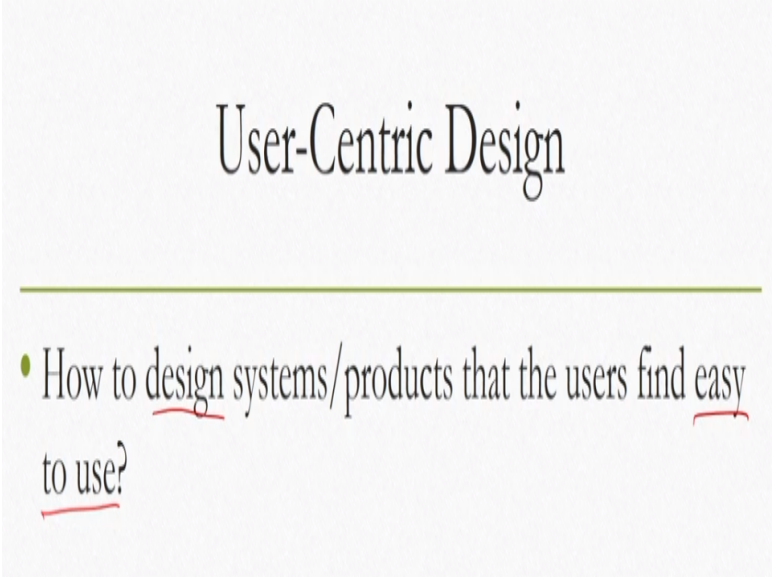

Now the main concern here is how to design the system so that users find it easy to use. So that is the main challenge to a interactive system design.

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In order to have a better understanding of this challenge let us discuss an example system which is ubiquitous most of us have seen it. This is an example if a, TV remote control now probably all of us have used one of such remote controls.

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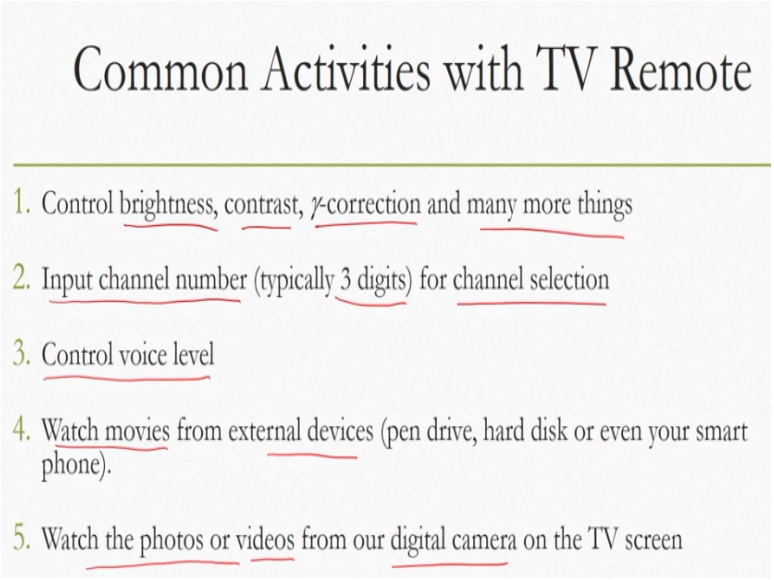

What are the activities that are typically with such a device? We can control brightness, contrast, gamma correction and many more things with the device. We can input channel number typically 3 digits but it may be different in different locations. To select a particular channel you can control voice level. We can do certain other things like watch movies from external devices attached to the TV or watch or view photos or watch videos from our digital camera after attaching it to the TV. And all these things we can do by interacting with the TV through this remote control.

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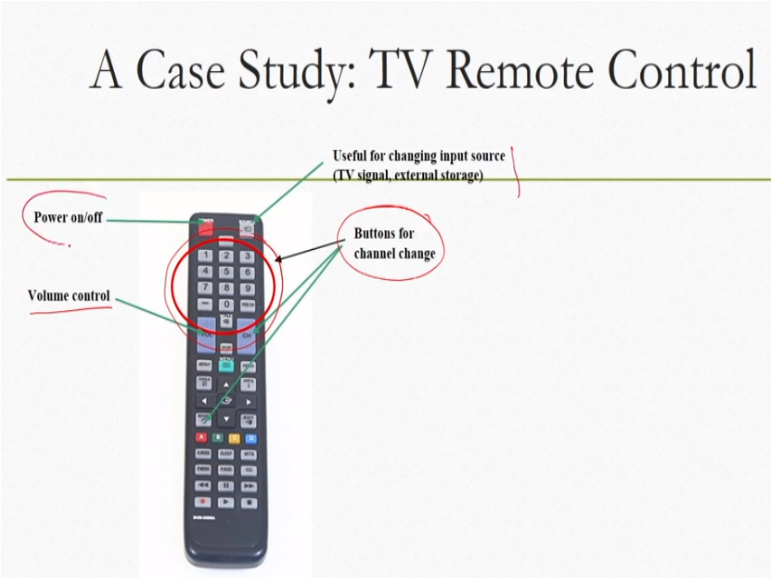

So in the example remote control that we are discussing let us see which portion deals with which of these activities. Now this top region shown in red circle typically has buttons for channel change, volume control additionally it also has couple of buttons for change in input source as well as power on off button.

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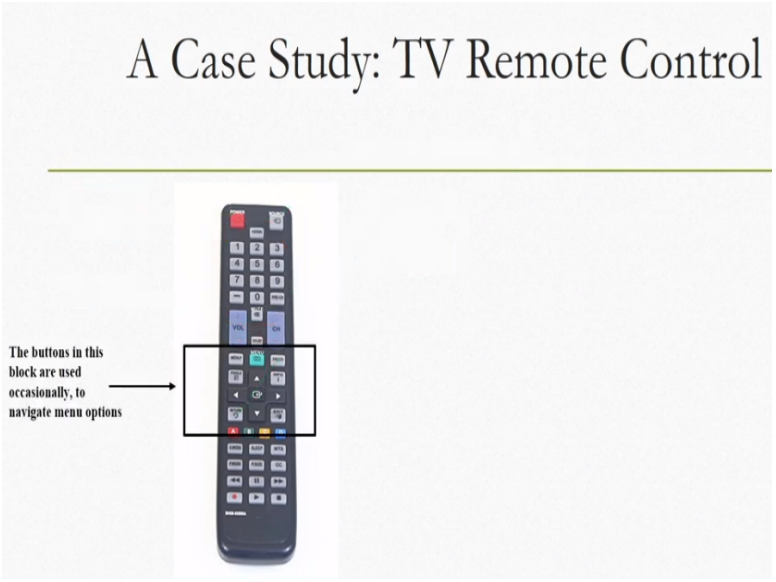

There is another group of buttons in the middle of the device which are used occasionally to navigate various menu options.

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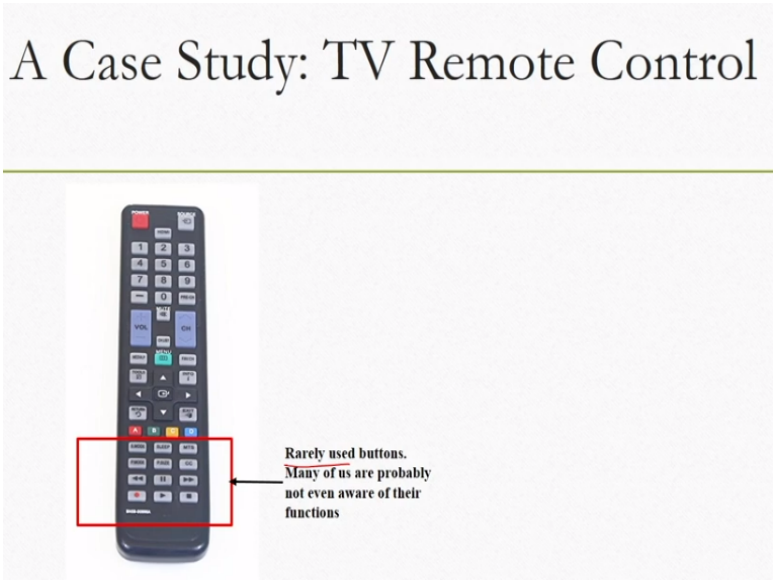

And finally there is a third group of buttons which are rarely used actually many of us may not even be knowing what are the purpose of these buttons. Because either we never use them or use them so infrequently that we forgot. So among these 3 groups the first one involving buttons for channel change or volume control is likely to be most frequently used group of buttons. Whereas the third group of buttons is the list likely to be used buttons.

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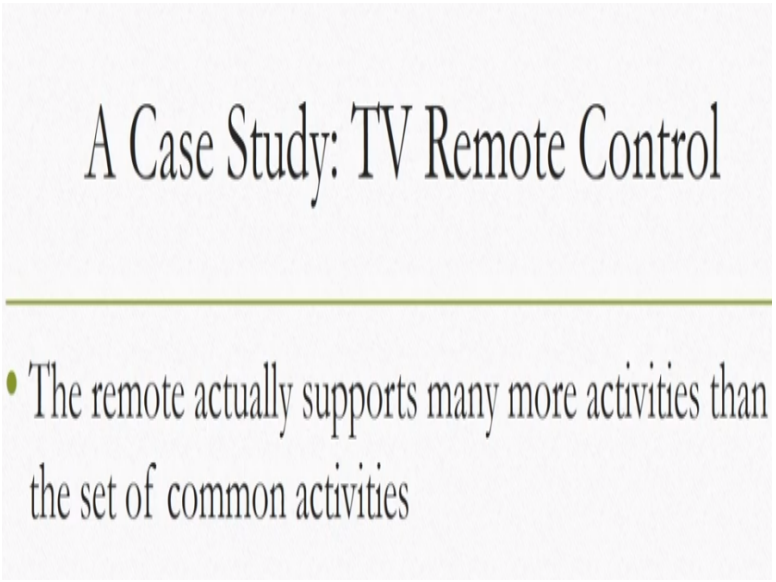

But the thing is that in the same device all these buttons are provided. So this third group actually supports many more functionalities which we may not require frequently. In fact in most of the cases we never require it.

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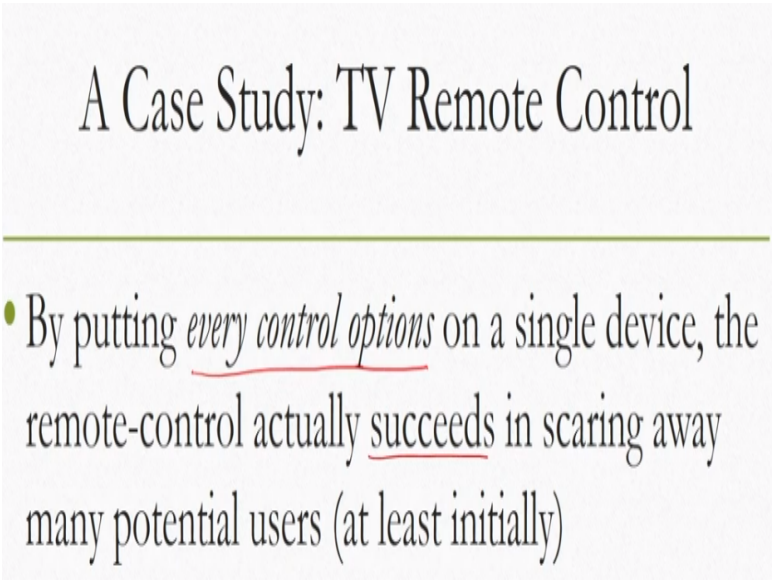

Now the thing to be noted here is that in the same device we have all the buttons are put on the same device. So same device contains every control options considerable and supported by the TV when is the result for such a design? It actually succeeds in scaring away many potential users initially. But of course since it is a very simple device with few days of usage people tend to learn.

But again as I said this third group of buttons will never be learned because those are very infrequently used or not used at all. Whereas the first group of buttons is likely to remembered and used most frequently so what could have been done?

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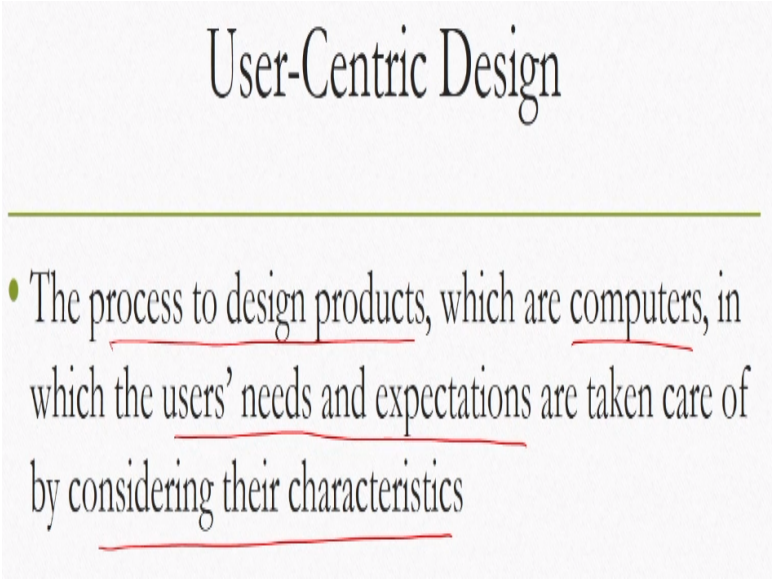

Instead of designing it in this way it could have been designed in such a way such that the most frequently used buttons are kept in very prominent way and the least frequently used buttons are not given the same prominence as the most frequently used that would have probably emphasized the relative weight of the or relative importance of the buttons to the users and accordingly the user would have tried to learn them.

So this example tells us that user centric design is very important where it refers to the process to design products which are computers in which the user needs an expectation are taken care of by considering their characteristics. So we should know who, are users of this remote control likely to be everybody what are their needs and expectations as I have already mentioned.

Mostly they require this first group of buttons accordingly we should have designed and we probably should have kept the other buttons not in a very prominent position. So that the user should not; have been intimated it by the presence of so many control options.

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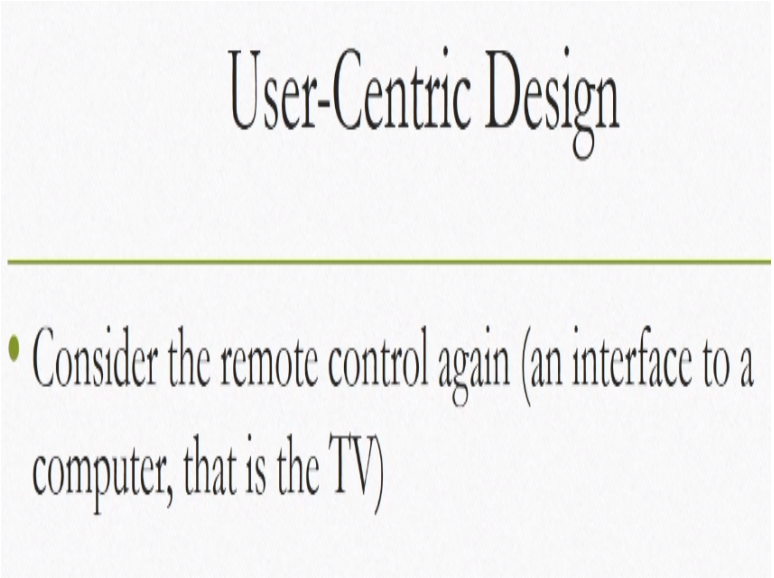

So this remote control we can think of as an interface to the television rather than TV itself.

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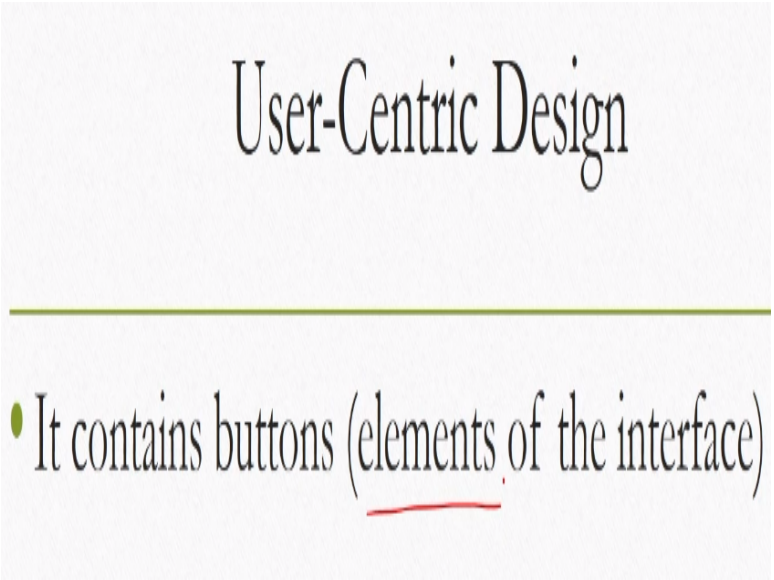

Now if we again consider this example so since user centric design is our focus so if we again consider this example let us try to understand what we are trying to design? What we are trying to do differently so that this product becomes user centric? Now the remote contents buttons which we can call as elements of the interface to a computer which is the TV.

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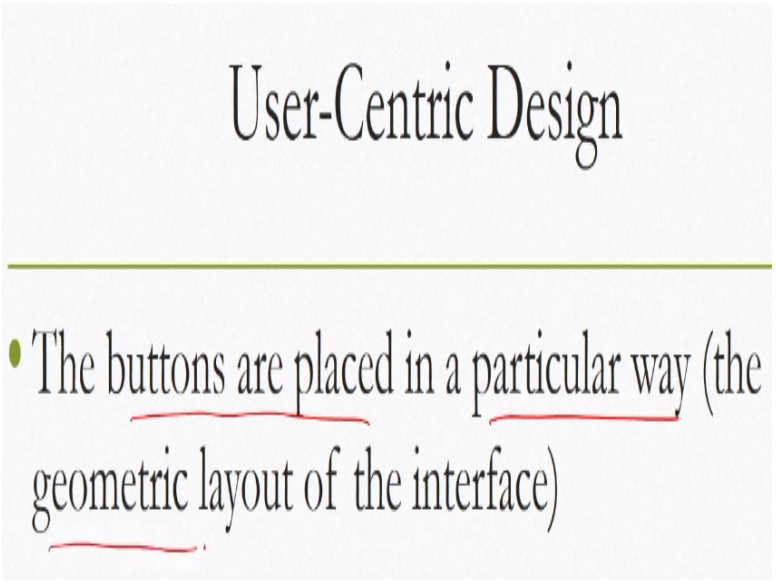

That is the first to note second thing is these buttons are placed in a particular way which actually defines the geometric layout of the interface.

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That is the second thing to note a geometric layout of the interface then when we interact with the TV using the remote. For example to select a channel we visually perceive the system state and its change from the TV screen or from the display so that is the third element of an interactive system. And finally we continue the performing the operation till we are sure that till we are achieved what we wanted?

That is the system state matches with our goal state as per our perception so when we are talking of designing a user centric product or system there are 4 things we should consider. One is the interface element their geometric layout the perception of the system state and

matching of the system state with our goal state. So these are issues that we should be concerned about while going for designing a user centric system.

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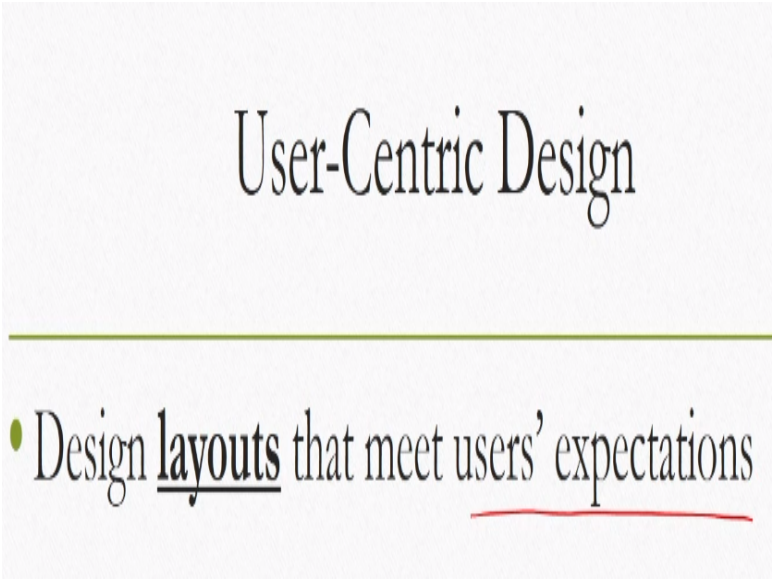

That means in other words so 4 things we should take care of in user centric design. First thing is design the elements that are acceptable to the users not the word acceptable then design layout that meet user expectations. So any layout is not good so first we need to know the expectation of the users and accordingly we need to design it.

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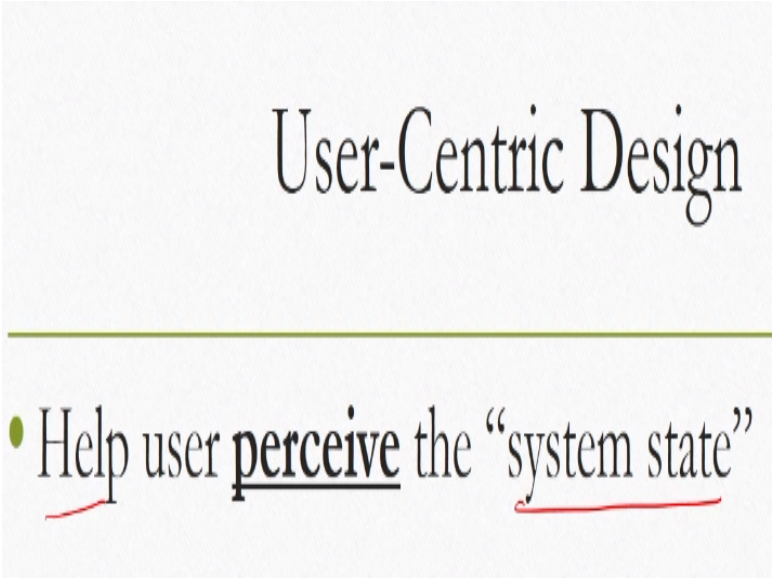

Then help the user perceive the system state so design the display in such a way. So that the state of the system from the users point of view is easily understandable.

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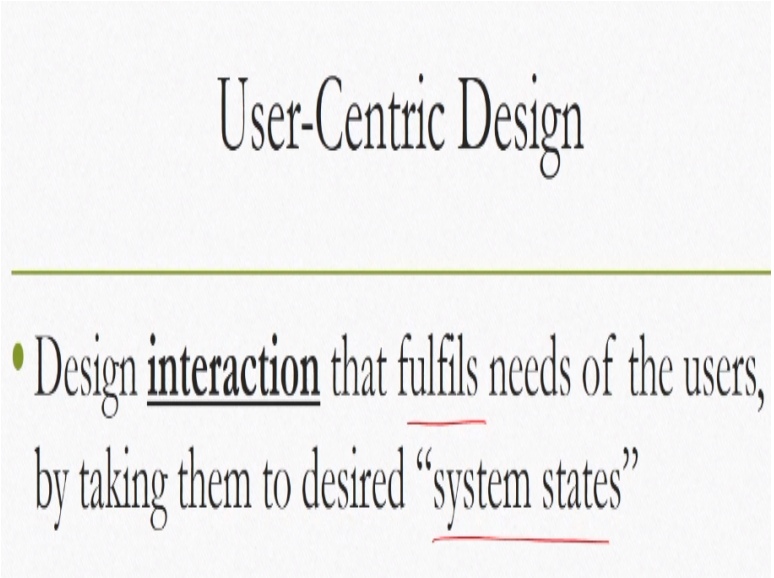

And finally design interaction that fulfils the needs of the users by taking them to the desired system states. So design element, design layout, design display interaction these 4 are the primary things that are designer of the interactive system should be aware of or should be conscious about while going for a user centric design.

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So with that let us learn a little bit of how this field that user centric design evolved over time. So we will briefly mention about the mile stones that have been achieved during this journey of last few decades.

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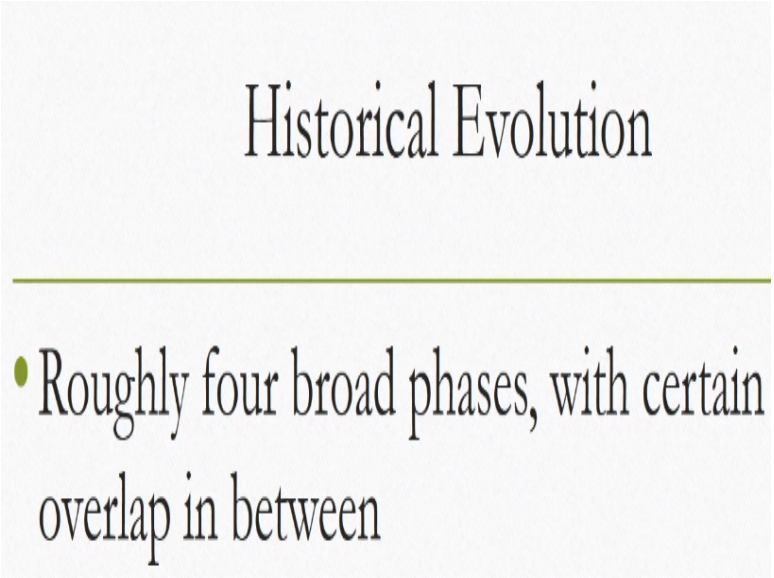

So let us briefly learn about the historical evolution of this field of user centric design. So this evolution we can broadly divide into 4 phases, not very distinct there will be some overlaps in this phases but we can still broadly divide it into 4 phases.

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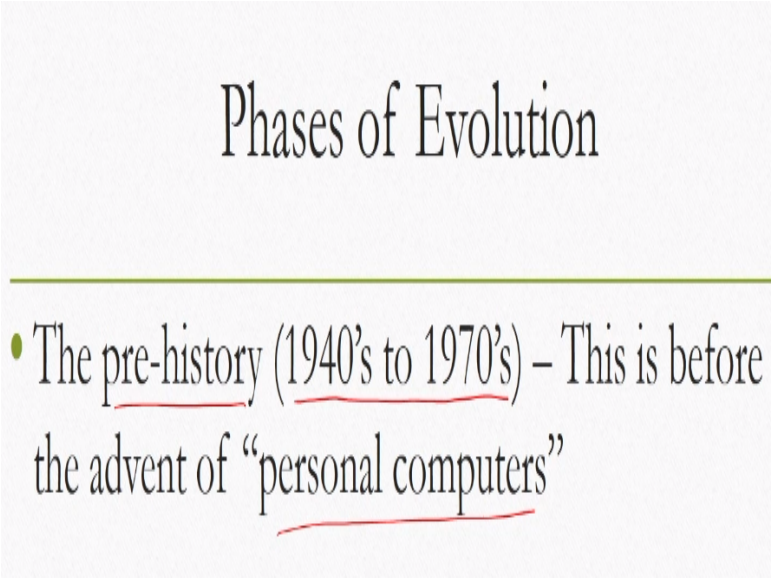

The first phase is we can turn it as pre-history which is the period between the nineteen forties to nineteen seventies in the last century. This is before the advent of the so called personal computers. So during this phase also as we will see several developments took place that advanced this field of user-centric design.

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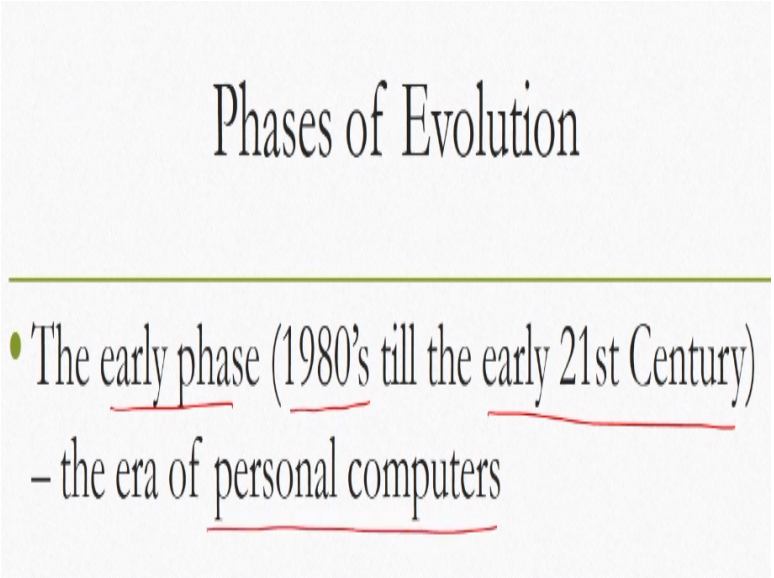

Then comes the early phase which is roughly; from nineteen eighties till the early twenty first century which is or can be considered as the era of personal computers.

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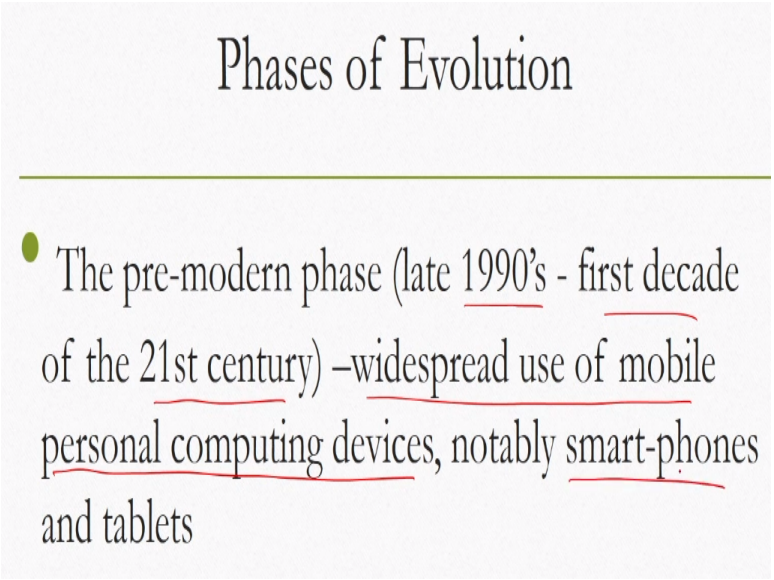

Then the pre-modern phase late nineteen nineties to the; first decade of the twenty first century. Now during this; phase widespread use of mobile personal computing devices have been observed notably smart phones and tablets.

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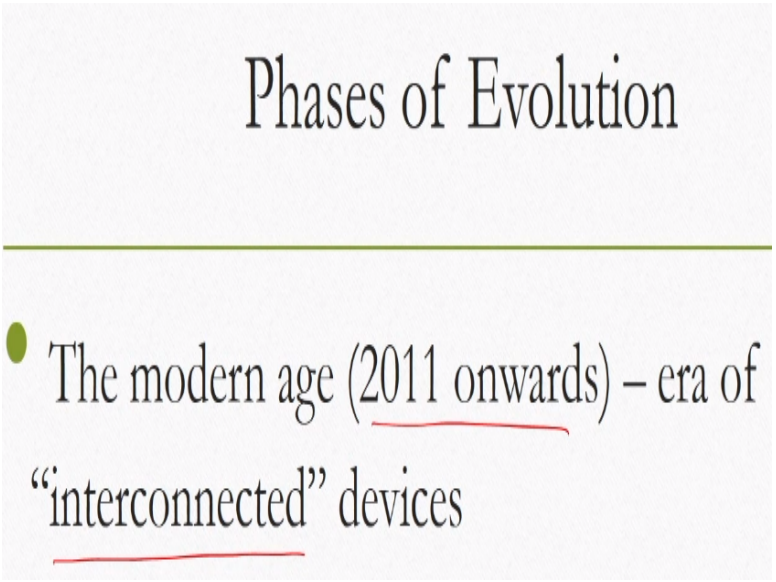

And finally we can think of the modern age which is continuing which is the era of inter connected devices. Now let us see what are the mile stones that have been achieved in these 4 phases?

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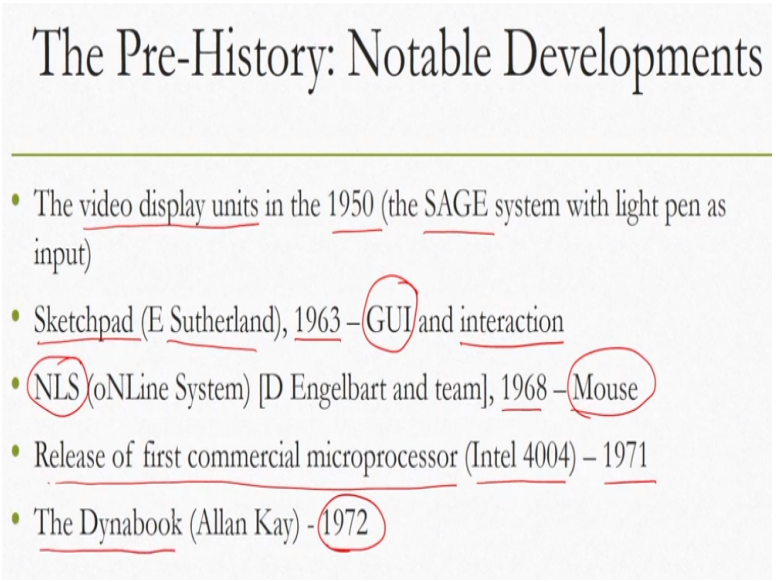

In the per-history phase that is between nineteen forties to nineteen seventies before the advent of personal computer. We have several important milestones so in the 1950 the first video display unit came out which is called the Sage system. Then 1963 one interesting system was developer called sketchpad by E Sutherland. Now it introduced the idea of graphical user interfaces and the concept of interaction.

Then can the online system or NLS proposed by Engelbart and team in 1968 which introduced an important interaction device which is uibiquitous as the Mouse. The release of

first commercial microprocessor named Intel 4004 happened in 1971 which revolutionized the computing landscape. And finally in 1972 one product was developed although it was not commercially very successful the Dynabook by Allan Kay which is a precursor to the personal computers.

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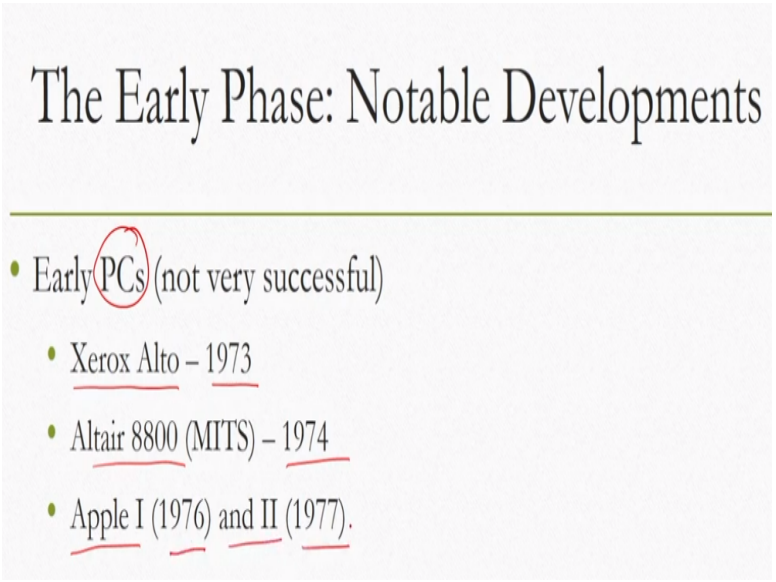

As compared to this phase the early phase had less number of milestones it primarily consists of the early personal computers Xerox alto which came in 1973 then Altair 8800 1974 Apple 1 1976 and apple 2 1977.

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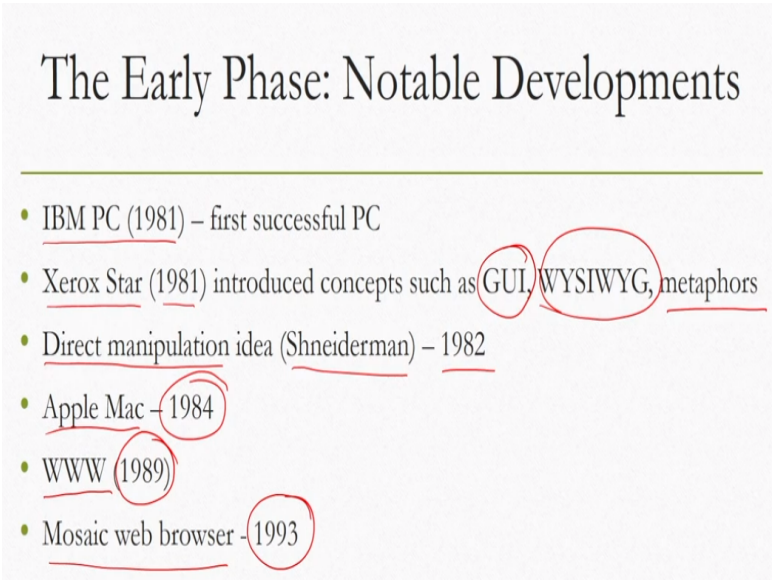

The most impactful development happened in 1981 with the advent of IBM PC or personal computer. Then Xerox star in 1981 also introduced the concepts such as graphical user interfaces then WYSIWYG or what you see is what you get concept then the idea of

metaphors which have profound impact in the development of user centric systems. Almost at the same time in 1982 the concept of direct manipulation came into being proposed by Shneiderman.

Then Apple Mac was released in 1984 again another important milestone in that phase the idea of World Wide Web came about in 1989 and the first wave browser was developed in 1993. So all this actually have profound impacted the advent of the user centric design area.

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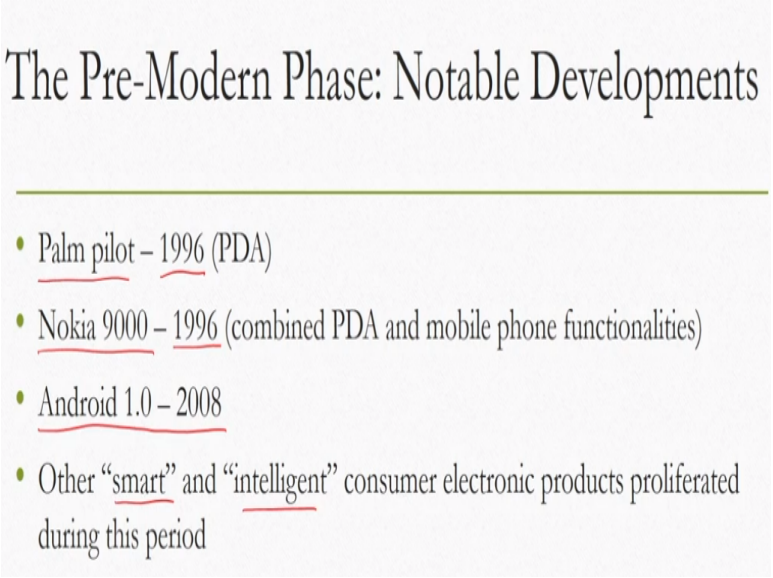

In the pre-modern phase we had pump pilot in 1996 which is the first example of the successful mobile device. Nokia 9000 which came in 1996, then in 2008 Android 1.0 was released which revolutionized the smart phone landscape. Also during this period other smart and intelligent consumer electronic products proliferated which again affected the advent of user Centric design field.

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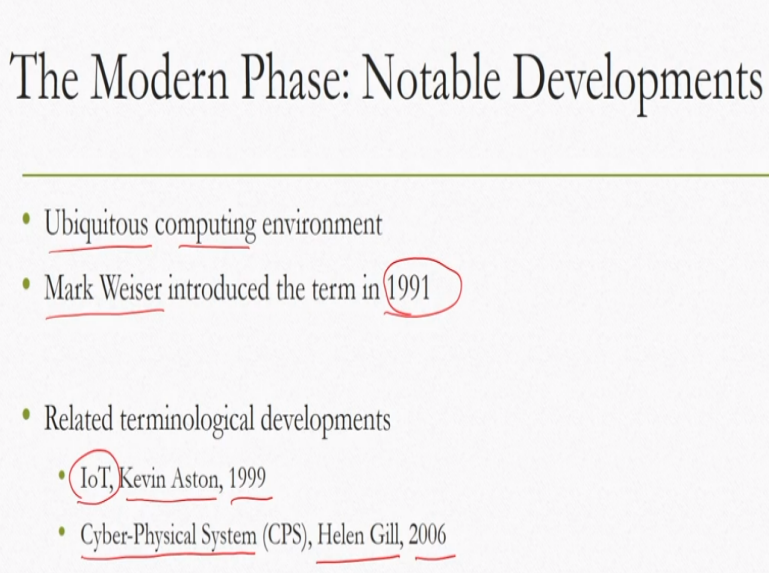

Finally we came to the modern phase although in this phase the smart phones still there but the main landmark even that happened is that. Now we are no longer talking about personal devices the single device instead we are more concerned about connected devices in the ubiquitous computing environment where the devices are connected to each other to given better experience to the user.

Now this term was first proposed by Mark Weiser way back in 1991 and during this period some other related developments happened which are closely related to each other namely the development of internet of things or rather the development of the concept of internet of things by Kevin Ashton in 1999. Then the Cyber physical system concept or CPS by Helen; Gill in 2006.

All these referred to the idea that now the idea of personal computer has been changed from one user one computer to one user many computers where computers are not treated as computer rather they are treated as any other real like daily objects. And we just use them like we use any other objects in our daily like. So we are actually using computers without being aware of the fact that they are computers. Now this conceptual change happens in this modern phase which is still going on.

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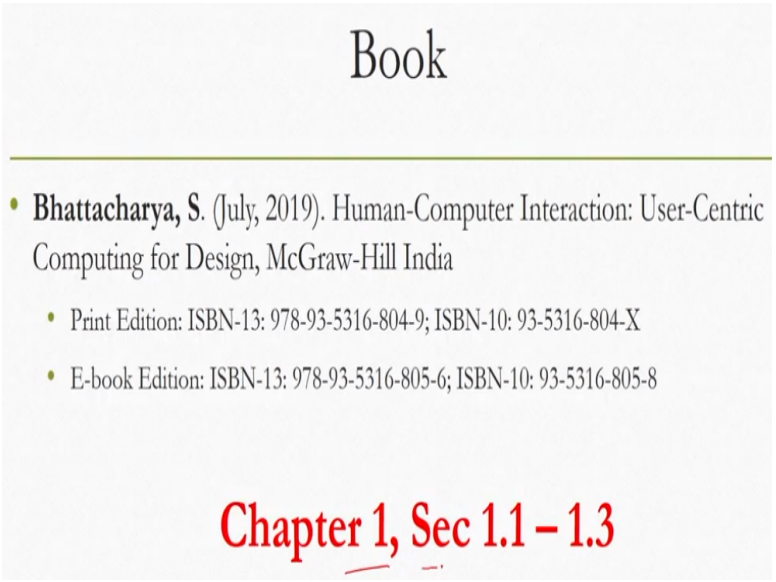

So with that we have come to end of this first lecture to recap here in this lecture we learned about what is an interactive system how it is different from other systems? What are the issues that we should be aware of while going to design an interactive system? And what is the basic idea of user centric design and a brief historical evolution of the field f user centric design. The material that I have covered today can be found from this book have a look at chapter 1 section 1.1, 1.3. So that is all for today see you in the next lecture thank you and goodbye.