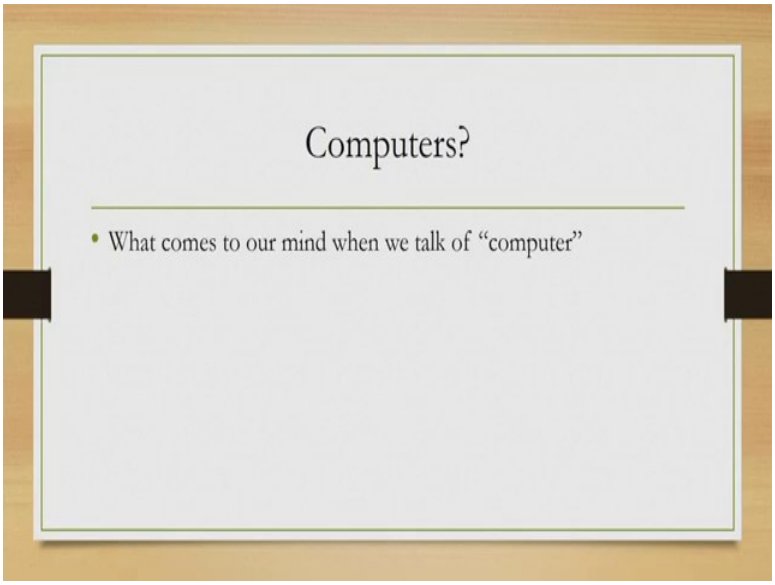
User Centric Computing for Human-Computer Interaction

Prof. Samit Bhattacharya
Department of Computer Science & Engineering
Indian Institute of Technology, Guwahati

Lecture - 01
Introduction to UCC and history

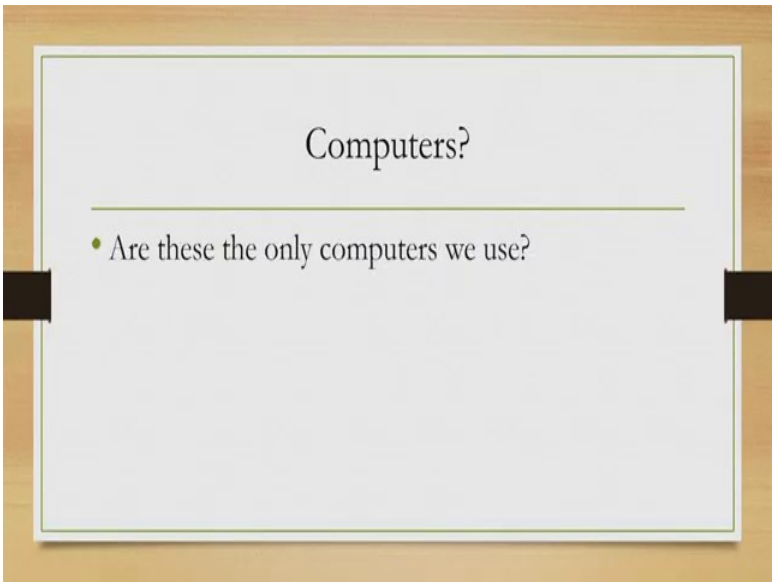
Hello and welcome to the course User Centric Computing for Human-Computer Interaction and this is lecture 1. So, as you probably have noticed the course title include the term computer and computation.

(Refer Slide Time 00:51)



So, what is computer? If I ask you this question what will be your answer?

(Refer Slide Time 01:16)

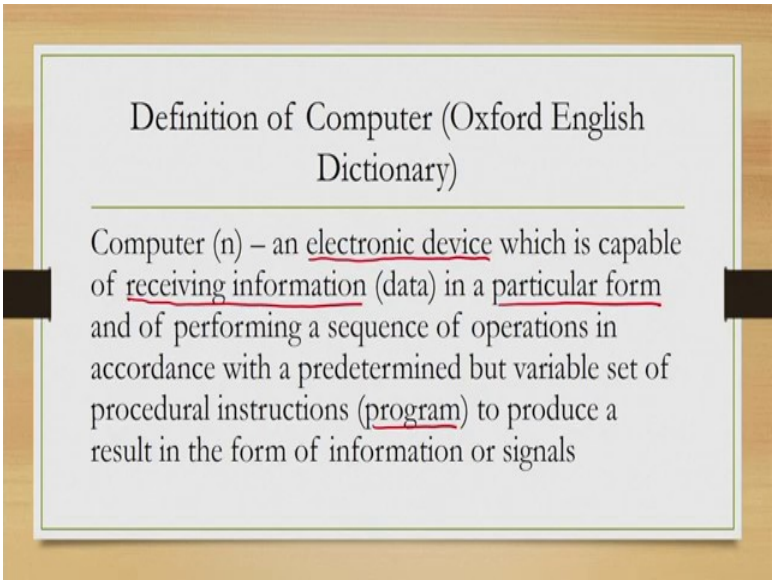


Now, the answer actually varies if the question is asked to someone who belongs to slightly older generation; the answer will most probably be a desktop or a laptop computer. Now, if the same question is asked to someone who is slightly younger, the answer may be different; it may be most likely smartphone, tabs along with probably desktop or laptop. Both are valid of course, but when I say that or when I use the term computer, do I really mean only these? Are these the only computers? The answer is no, actually we are nowadays surrounded by many computers.

(Refer Slide Time 01:46)

Let us see one example; now this is, as you may know, is a digital pedometer. Now, if I ask you the question, is it a computer? What will be your answer? Before we answer this; it will help if we just go through the definition of a computer once.

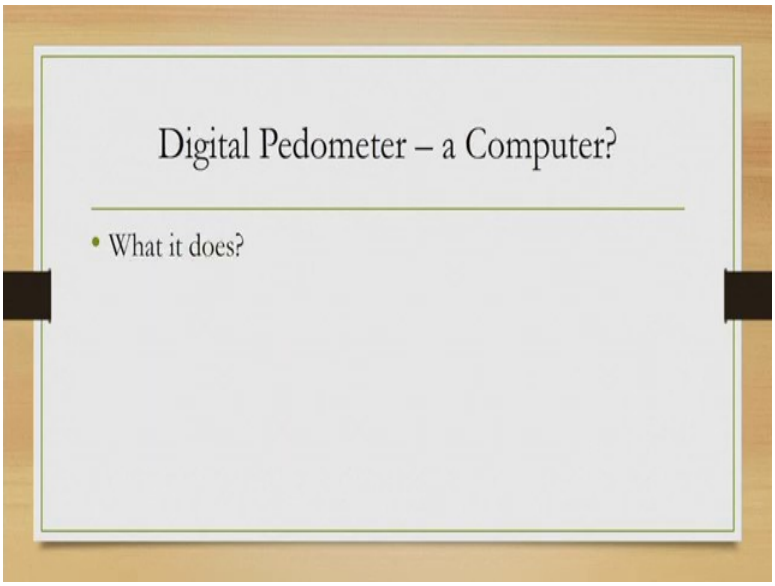
(Refer Slide Time 02:05)



According to Oxford English dictionary; a computer is an electronic device which is capable of receiving information or data in a particular form and of performing a sequence of operations in accordance with a predetermined, but variable set of procedural instructions, collectively called a program, to produce a result in the form of information or signal.

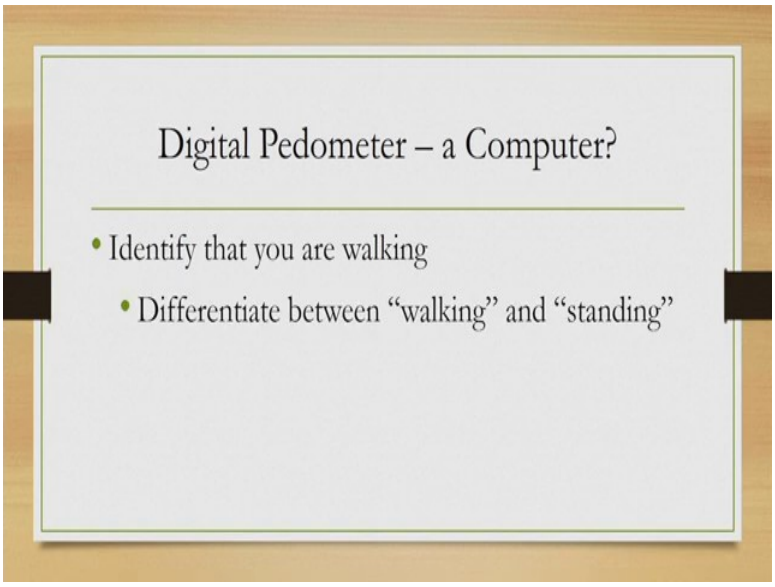
So, the key things to note in this definition is that a computer is an electronic device; let me highlight the terms “an electronic device”, which is capable of receiving information or data in a particular form and of performing a sequence of operations in accordance with the predetermined, but variable set of procedural instructions collectively called a program to produce the result in the form of information or signals. So, it receives input from users and uses a program to process that input to produce some output.

(Refer Slide Time 03:19)



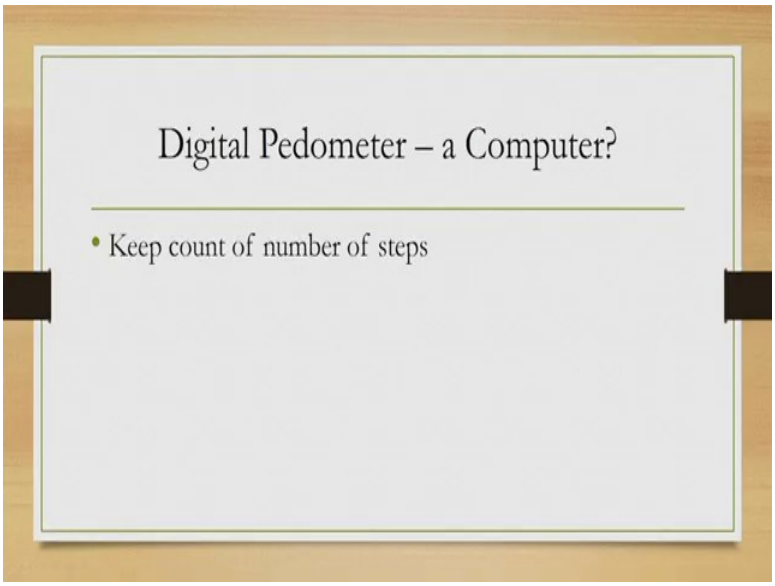
Now, let us see again the pedometer; what it does? We all know what it does.

(Refer Slide Time 03:22)



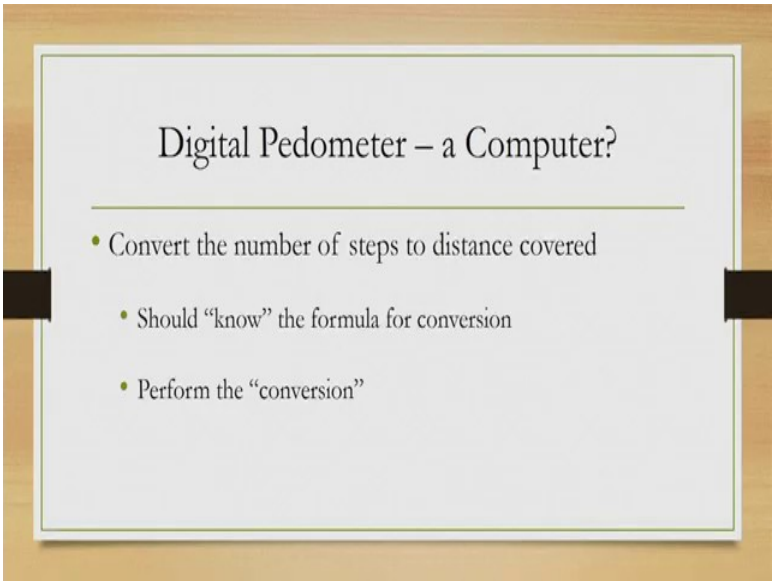
It basically does three things; first it tries to identify whether you are walking or not. That is, it tries to differentiate between your walking and standing.

(Refer Slide Time 03:34)



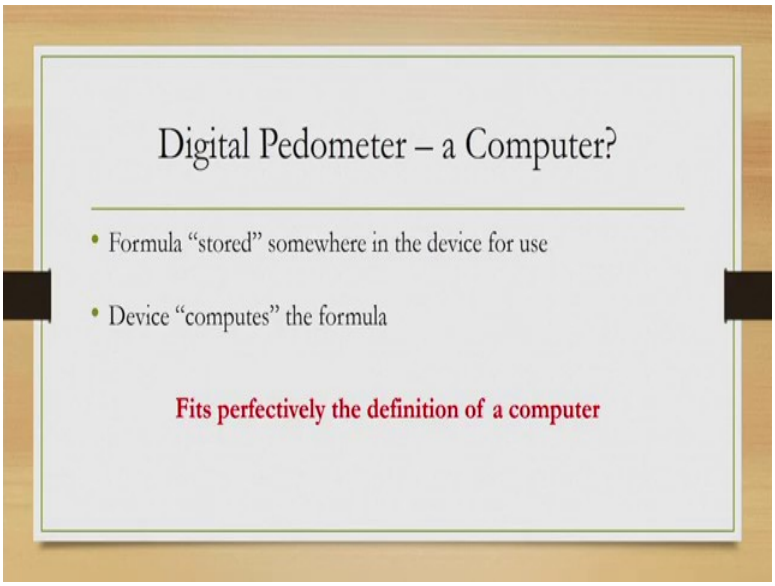
Then it counts the number of steps. So, now, that is not something very easy. In fact, you may get some idea of the difficulty if you yourself try to count it while you are walking, say, going for your morning walk or something and you will see how difficult it is, but the pedometer is designed to do that.

(Refer Slide Time 04:01)



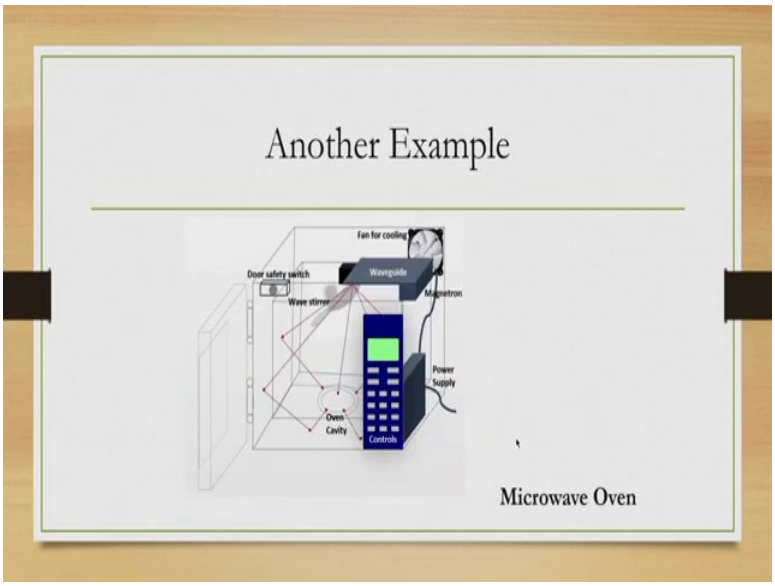
Then finally, it tries to convert the number of steps into the distance covered. Of course, we require a formula for that. Now, where does that formula is? The formula definitely is stored inside the pedometer.

(Refer Slide Time 04:15)



So, what it does is basically it takes input; it uses a program that converts the input to a distance and then it produces the distance in the form of the display. Clearly it fits the definition of computer - a perfect fit.

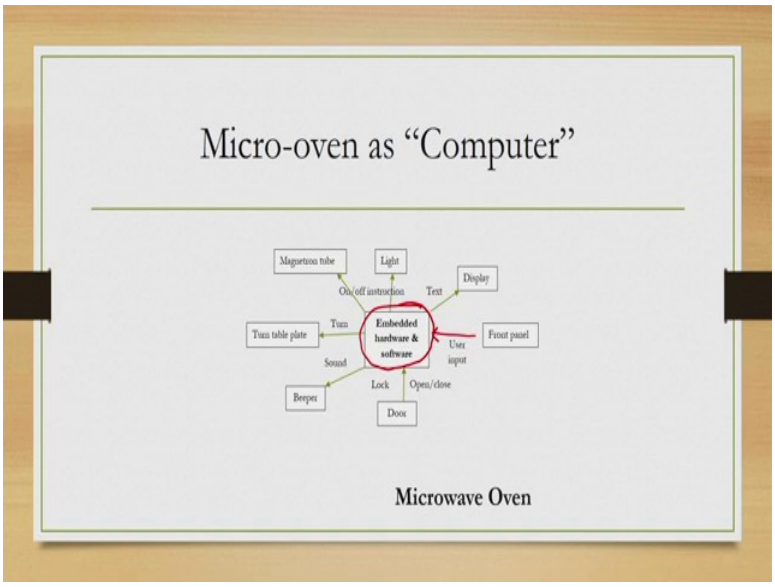
(Refer Slide Time 04:34)



Let us see another example. Again, like pedometer, probably this one also you are, most of you are, aware of. This is a microwave oven. It contains various components including one control panel. That is the one through which you provide some input to the oven and there are other things, which are not directly accessible to the user.

Now, does it satisfy the definition of a computer? Let us see how it works.

(Refer Slide Time 05:01)



If I break it down into a schematic diagram with different components, then broadly we can identify that there is a core. A core which consists of embedded hardware and software - this is the central part.

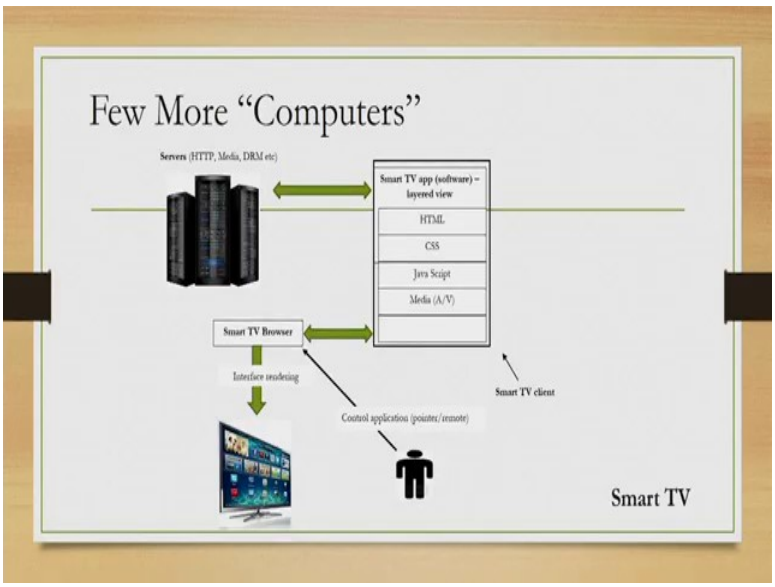
Now, around this core there are other components attached to it; for example display, light, magnetron, tube, turntable plate, beeper, door and front panel. But among them, the user only uses the front panel to provide some input to the core. And based on that input, the core produces an output, which may be used to display something or may be used to control the light, may be used to control the magnetron tube, may be used to control the turntable, may be used to produce a sound like beeper.

Along with of course the user input, the microwave oven can also take input from sensors attached to door. So, the sensors will indicate whether the door is open or close and based on that it can take certain actions. Now, all these actions that it takes based on the input either from sensor or user are basically stored in the form of a program, which produces the output based on the input. So, again this fits into the definition of a computer.

(Refer Slide Time 06:34)

Let us see a third example. Now, this is a smart TV. Again all of you probably are aware of this smart TV. What a smart TV is? In fact, nowadays most of the TVs claim to be smart. Now, why we call it a smart TV? Because it supports certain activities that we typically associate with computers or smartphones. So, these activities, how these activities take place?

(Refer Slide Time 07:07)

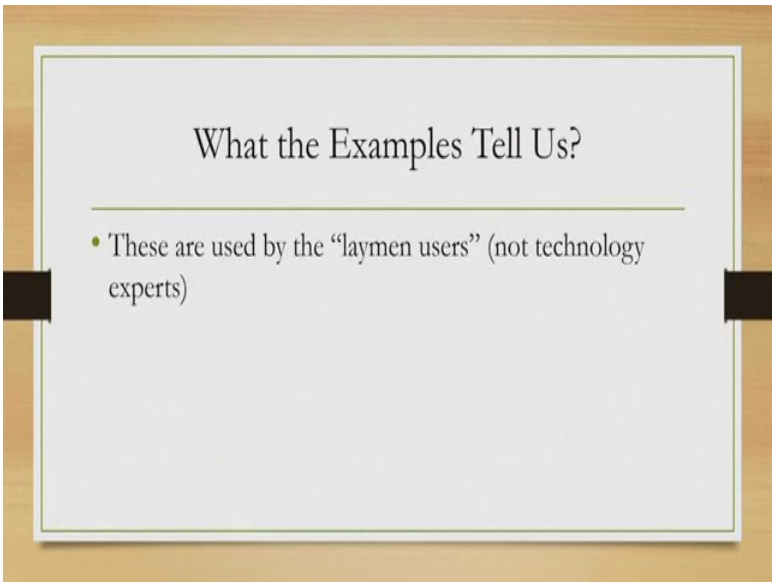


If we take a closer look, we will see that the smart TV contents lot of things that are very complicated. So, what we get to see is the interface; behind the interface is a program

stack where different programs are there to handle different activities. And these activities are related to the smart features of the TV and one important activity is that many of these features are supported by connection to a server which basically provides certain services to the TV and this connection again takes care of the computational aspects.

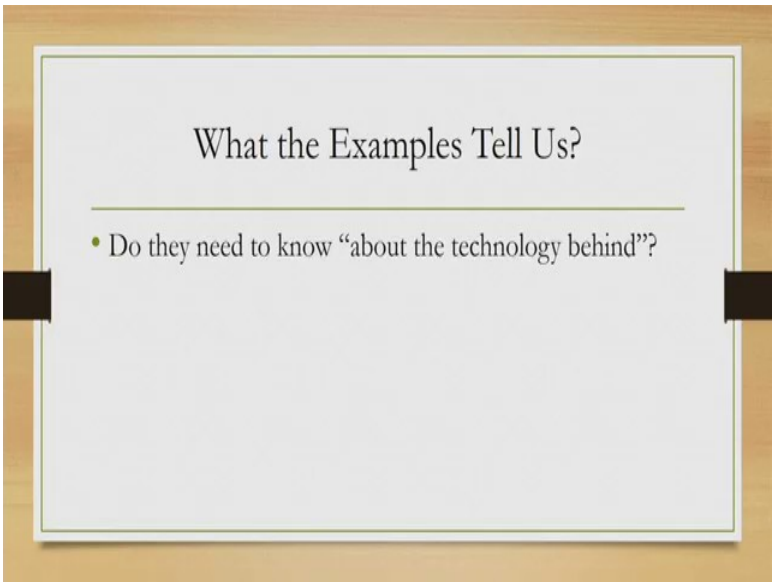
So, when we talk of a smart TV; we are actually talking of an embedded program that connects to a server, fetches some services from there and renders it to the user through an interface that is the browser; TV browser. Along with that the services are fetched based on the input provided by the user through maybe gestures, through maybe some other control mechanisms, through maybe press of buttons. So, it takes user input and it has an inbuilt program that processes that input and produces some output. So, the definition of computer matches here as well and this we can categorize as a computer.

(Refer Slide Time 08:40)



So, we have seen three examples - pedometer, a smart TV and microwave oven. What these examples tell us? First of all these devices are used by people who are laymen users; who may not know the technology that are there inside the systems.

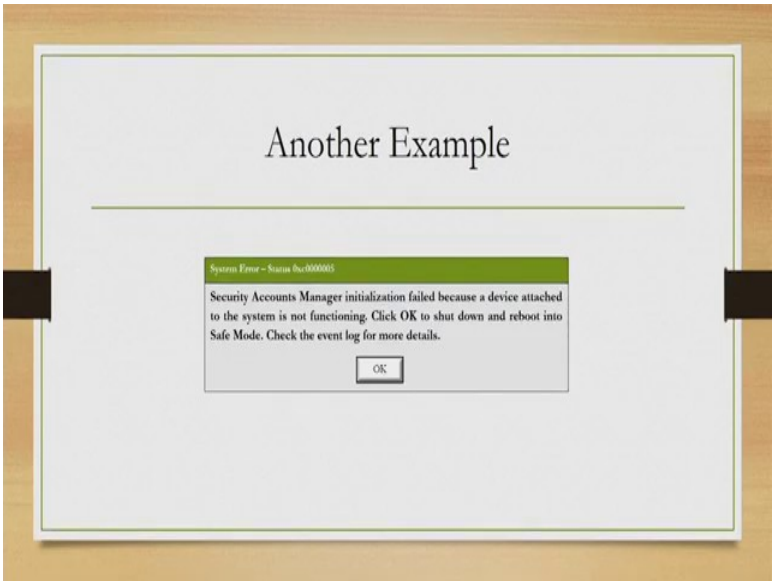
(Refer Slide Time 09:07)



Now, that is one crucial thing that when we are talking of computers; we are probably aware of it that it is computer, it is complicated system, it requires some technological expertise. But when we are talking of a TV we may not be aware of the complexity involved, but we want to use it.

Now, the question is do the users really need to know that they are dealing with a complex system; they are dealing with a computer or they are dealing with a very complex technology?

(Refer Slide Time 09:31)

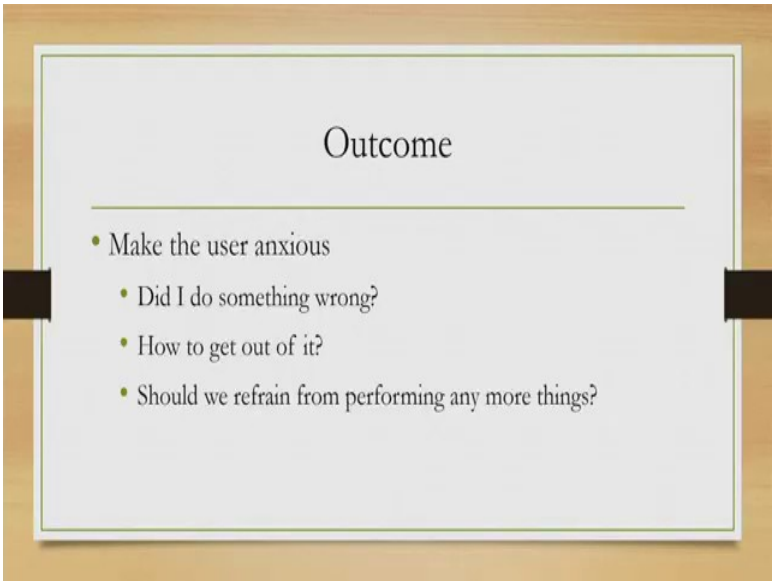


In order to answer this question let us see one more example; consider this message this is an error message; what it says? That there is some system error with the status code a hexadecimal code and it says that a particular service that is security accounts manager has failed because of certain things and the only option to use press one button OK and it will shut down and reboot your system; in a particular mode called the safe mode. Then you are advised to check the event log for more details.

Now, what do you think of this message? It contains many technical information for example, the error code which is a hexadecimal number. Of course, many of us who do not know this type of number system may not be very comfortable with such numbers. Secondly, it is talking of some service, some security accounts manager then it is talking of some event log, it is talking of reboot, safe mode many things

Now, if I am using a computer and such a message is shown to me where I do not know probably what those things are. So, what will be the result?

(Refer Slide Time 10:52)



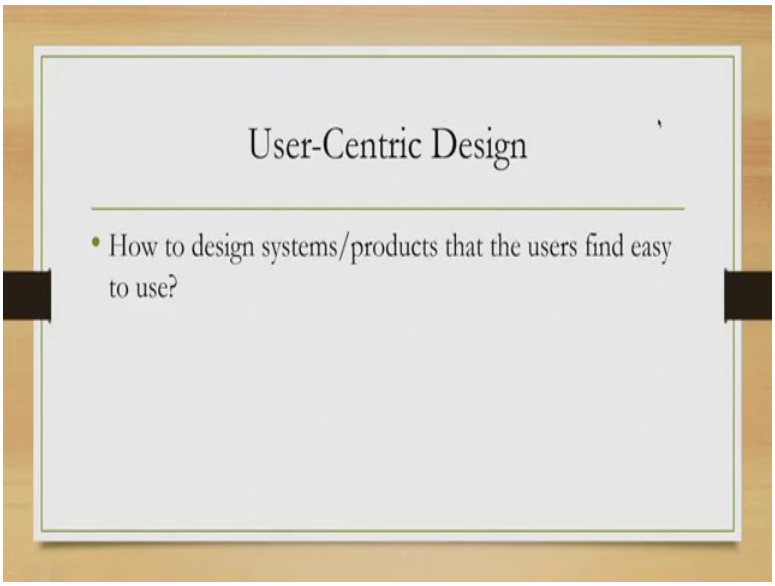
Most likely it will make the user anxious; the user will start thinking did I do something wrong? How to get out of this situation? Now I do not know what I have done. So, should I do something more should I keep on using it what if such errors occur again; is it going to destroy my system many such questions will arise in the mind of the user and that may lead to the loss of motivation for the user to use the product or the system.

So, of course, if we are showing something very technical to someone who is not technically sound in that particular area definitely it may lead to undesirable consequences. So, then what to do?

(Refer Slide Time 11:40)

So, our objective in this course is basically to focus on the concept user centric where the designer of such systems which are supposed to be used by laymen users. So, design the systems in a way such that the users are not forced to learn the technology behind.

(Refer Slide Time 11:59)



That we briefly call user centric design, where the design takes care of the users needs, expectations and users find that design easy to use.

(Refer Slide Time 12:12)

Let us see another example a TV remote control; to get a better idea of what we mean by user centric design. Now, all of us have seen this remote control; if you look closely there are many buttons. So, what to do with those buttons? Now, if we think then we will see that we use remote control primarily for few important activities.

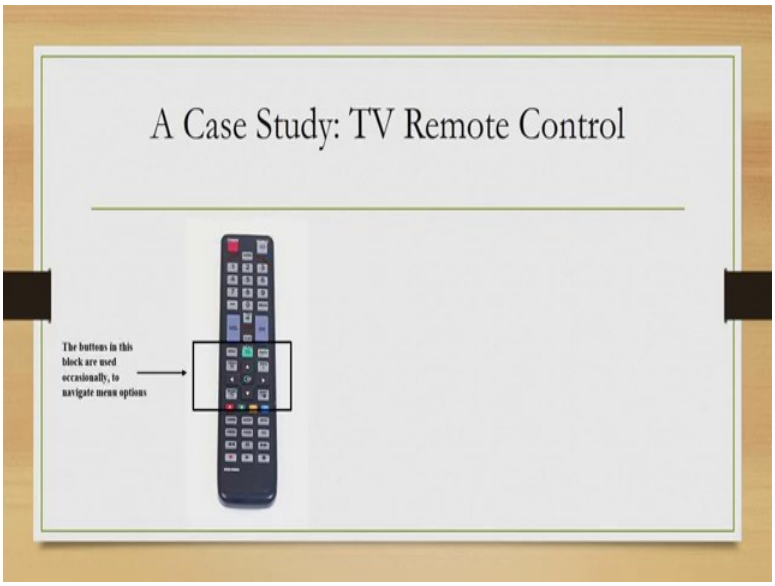
(Refer Slide Time 12:39)

There are five most popular activities done with a remote control. First of all, we use the control to control certain features of the TV for example, brightness, contrast, gamma correction. Then we use it to input channel number typically three digits to select the channel. Then we use it to control voice, sound level and we may use it because nowadays all TVs come with that facility; we may use the remote control to access the content from external device.

For example, we may watch movies stored in our hard disk which is attached to the TV using some buttons provided on the remote control. We may also watch or see the photos stored in a pen drive connected to the TV using the buttons provided on the remote control. So, these five are primarily the things that we do with the remote control. Now, let us see how the buttons are organized now of course, this is one example of a remote control other remote controls have different designs.

So, there the organization may be different, but in this case in this example as you see there are certain buttons on the top side which actually performs most of the common tasks; like volume control or channel change or selecting a channel and a button for selecting a particular input source whether this is the signals should come from the TV or from external storage like hard disk or pen drive; as well as power on off buttons so that you can switch on or off your TV from a distance. So, these are the buttons provided for common activities. Now, let us see the buttons; some other button what are the other buttons meant for.

(Refer Slide Time 14:39)



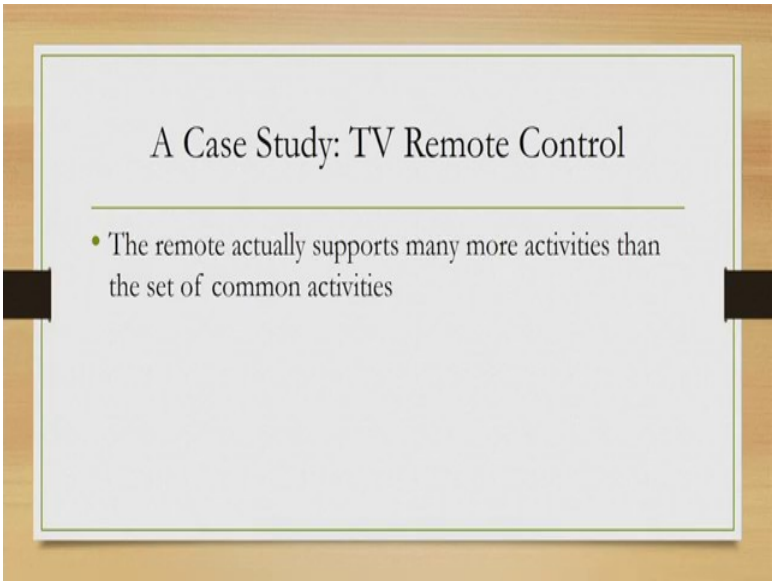
So, there is a set of buttons which are used occasionally maybe to navigate various menu options that are displayed on the screen or to select language in a particular program and so on. This if you not if you note are not very frequently used, but occasionally we use them.

(Refer Slide Time 15:03)

So, there is a third group of buttons which actually are very rarely used or not used at all and you can actually do a quick survey with the remote control you have; if you have these buttons among your friends you may ask whether they are using it how many times

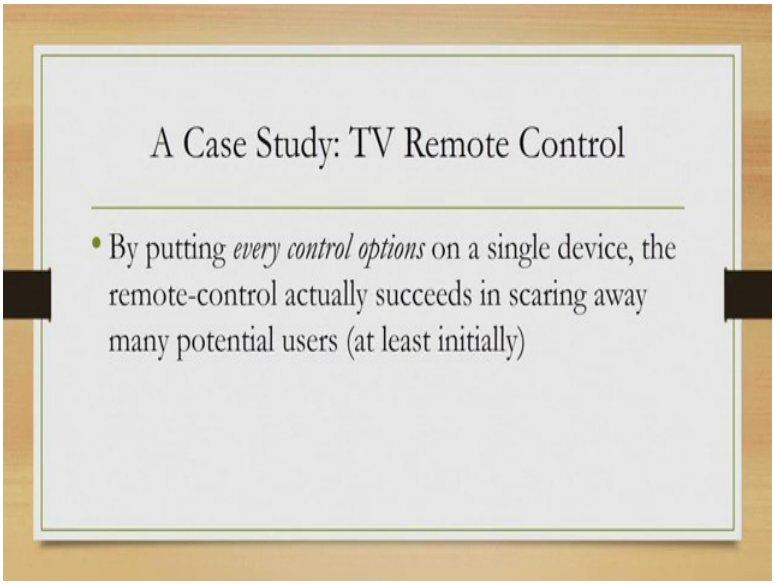
they have used it say in last one month and you will find out these group of buttons are very rarely used or almost never used.

(Refer Slide Time 15:31)



So, then what purpose does it serve? Actually, the designers wanted to support lot of features with this design. So, they provided all the buttons on the single device. So, the purpose is to support many features.

(Refer Slide Time 15:46)



Now, from the users point of view is it good by putting every control option on the single device? Actually the, but the design may scare away some of the users initially that is

quite possible of course, remote control is a very simple thing. So, after some length of use probably everybody will learn what to use and what not to use. So, it may not be a very big issue, but at the initial stage if I see so many buttons without the meaning clear; I will probably try to avoid instruction

One thing to be noted here is that all remote controls or TV with remote controls comes with some instructions, but really go through all the instructions before we start using it. So, the help manuals or instructions although they are there may not be of much use.

(Refer Slide Time 16:33)

So, then what we can say is that the process of designing products which are computers in which the users needs and expectations are taken care of is basically the user centric design. And while we are following a user centric design approach we need to consider the characteristics of the user.

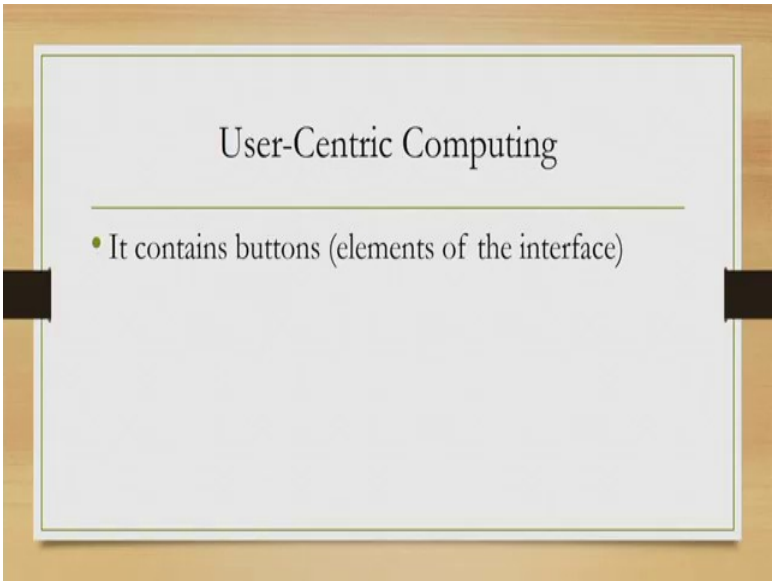
So, in case of TV remote which is an interface to the TV if we have followed such an approach probably many of the buttons would not have been given in the same device or probably, there would have been a slightly different design where the most common buttons are shown first and other buttons are hidden away in some in some different design.

Now, user centric design is one approach where we try to take into account the user characteristics and we try to design the products taking into account those characteristics

so that that is users find the product useful; easy to use. Now, if you may recall the course title is user centric computing for human computer interacts. So, then we are talking of not designed, but computing; so how these two are related?

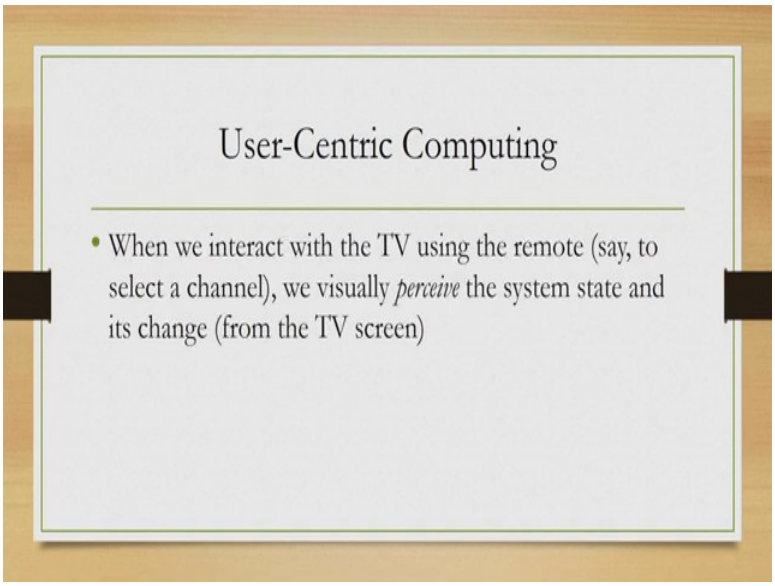
Now, in order to understand the difference let us reconsider the remote control example again which is an interface to a computer that is your TV.

(Refer Slide Time 17:57)



Now, the remote control contents buttons. So, these we can roughly call as elements on the interface; the buttons are placed in a particular way, this is the geometric layout of the elements on the interface.

(Refer Slide Time 18:09)



So, when we interact with the TV using the remote control; we get to see something on the screen, we try to see what is there on the screen that is we try to perceive the screen content which indicates to the user the state of the system. And by trying to perceiving the screen content we are trying to see whether our interaction with the remote control is changing the system state to the state which we want. So, suppose we want to select a particular channel and we are currently in another channel.

So, we look at the channel; then we press the right buttons, then we see if the new channel with its logo has come; if it has come then we know that the current state has been changed to our goal state and so we do not do it; otherwise we again try to type the channel number if there is some error and the error is also shown. So, we are trying to perceive the state of the system through the content on the screen and then we are trying to see whether we have reached the goal state that is the third component.

(Refer Slide Time 19:13)

And finally, as I said in the previous example of selecting a channel; we continue performing the actions till we reach the goal state. So, there are elements, there is the geometric layout of the elements there is this phenomena of perceiving the state and there is this phenomenon of trying to continue the operation still we perceive that we have reached a goal state. So, these are the four crucial components of the remote control interaction with the TV.

(Refer Slide Time 19:44)

So, then from these components we can generalize and say that to have a user centric product we should have four aspects of the design taken care off.

(Refer Slide Time 19:52)

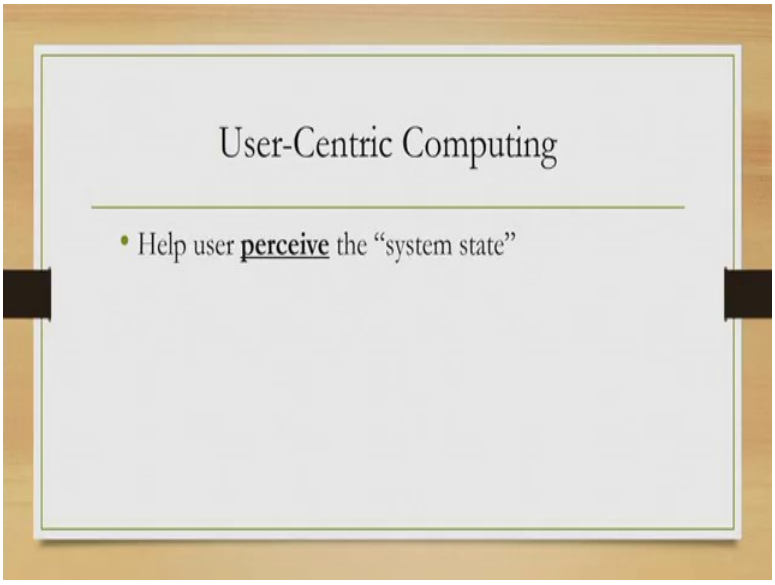
First of all the elements; so we should design the elements in a way such that these are acceptable to the user; there is some sort of aesthetics form factors all these things which makes them acceptable to the user.

(Refer Slide Time 20:08)

Secondly, the layout; so the elements should be organized in a way such that it meets the user expectation. So, I am expecting a particular button at a particular location, but

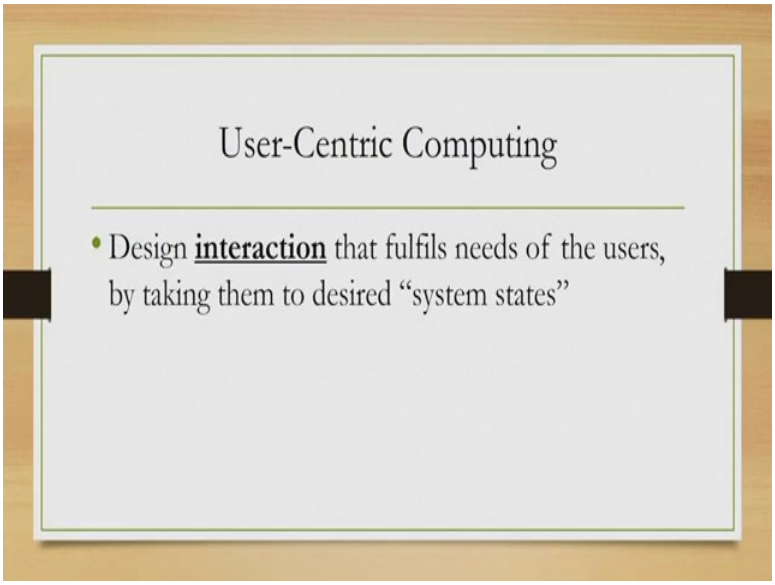
somehow the designer placed it in a different location. So, I might find it annoying; irritating to every time look for it rather than having it at the position where I expected. So, we have to know the expectation and accordingly design the layout.

(Refer Slide Time 20:36)



Then the way the content is displayed on the interface should be perceivable. So, we should design it so that the system state is perceivable to the user.

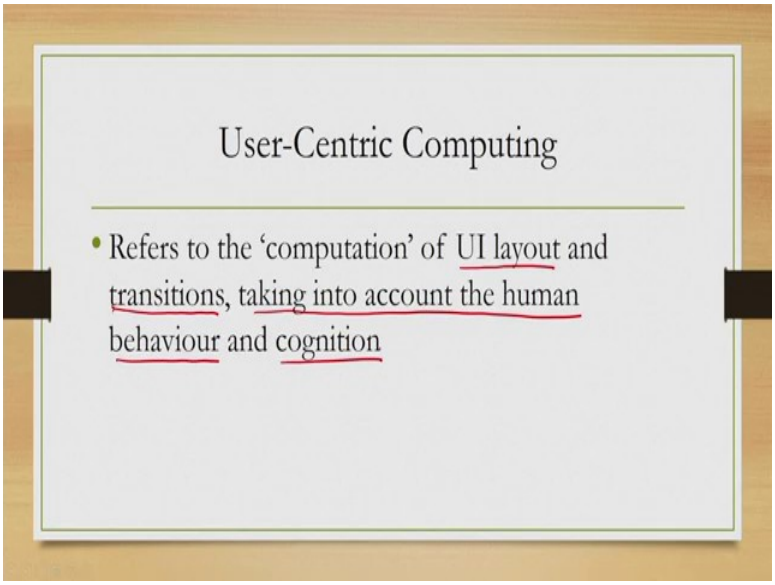
(Refer Slide Time 20:46)



And finally, we should design interactions that help the user takes; the system state to the desired or gold state that is also a very crucial component of the design of a user centric

product. Now, all these things take time. So, they are very time consuming and requires a lot of effort; we will see in a later lectures how much effort is required.

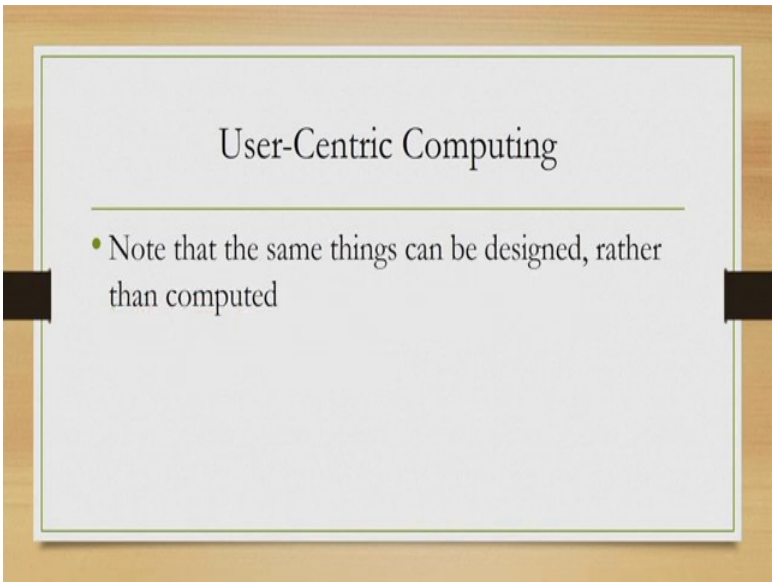
(Refer Slide Time 21:13)



Now, computing when we are talking of user centric computing; we refer to specific activities within this design process that is basically we want to compute the layout. So, essentially we want to compute the UI layout and the layout transitions. Now, these transitions are essentially the interactions and while we are trying to compute the layout and transition we take into account the human behaviour and cognition.

So, user centric computing refers to the computation that takes into account the human behaviour and cognition to design the layout and interactions. So, when you are talking of user centric computing; we are basically referring to this fact.

(Refer Slide Time 22:00)



Now, here one thing you should note that is although we are talking of computing the layout or computing the interaction those can also be designed.

(Refer Slide Time 22:13)

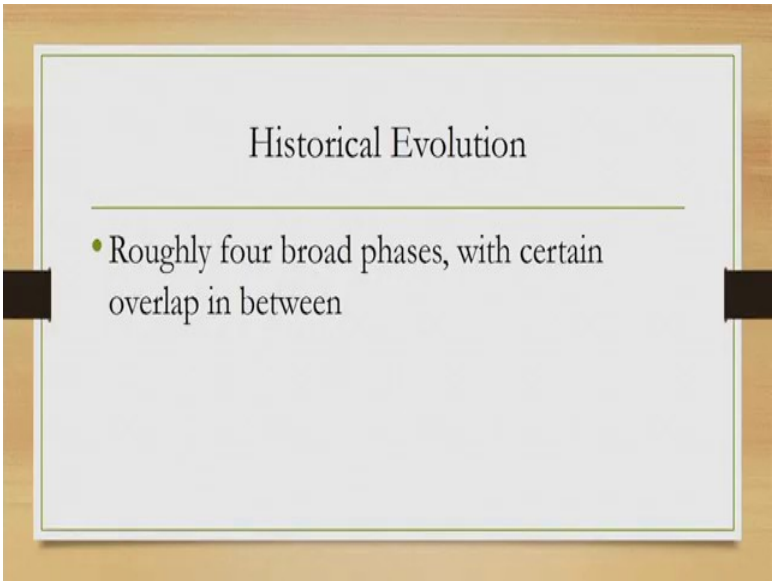
So, we can design the layout, we can design the interaction, but computations offer us certain benefits in terms of saving design time effort and creating adaptive interface. So, adaptive interfaces are a special class of interface where during your use of the interface the interface behaviour changes. The way you interact with the elements changes, the element their organization they may change. So, it adapts to the behaviour of the user.

Now, computational approaches are more suitable for design of adaptive systems rather than design based approaches and this is one advantage of user centric computing. So, essentially what we have learned is that we are surrounded by computers; there are many such computer and these computers are meant for people who are need not be technologically expert or need not know the technology that goes on behind these systems.

And, we want to make those systems easy to use for such type of users, we do not want to force them to learn the technology before they are allowed to use it. And, this design is time consuming certain aspects we can reduce particularly the time effort by computing certain design activities, but computation also gives us some other advantages particularly in the design of adaptive systems.

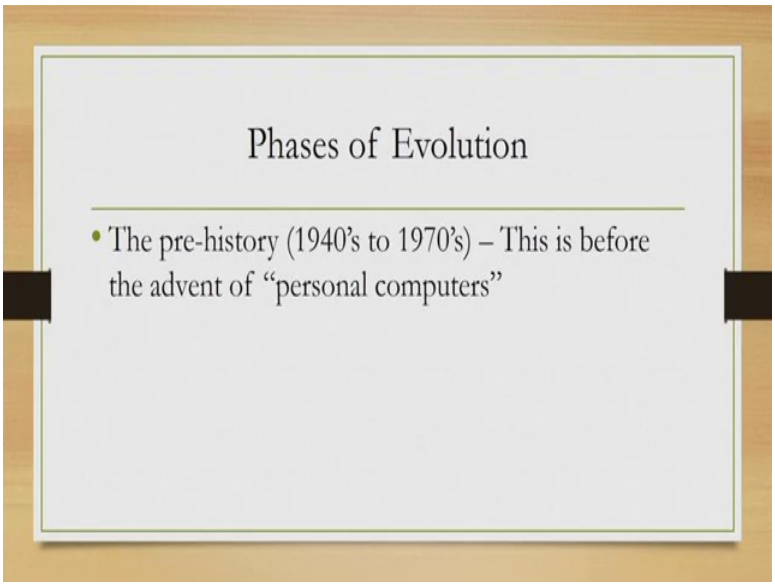
Now, we got some basic idea; now let us briefly see or briefly go through the historical evolution of the field. So, the field is related to user centric design and user centric computing and it is always beneficial; if we know what happened before.

(Refer Slide Time 23:58)



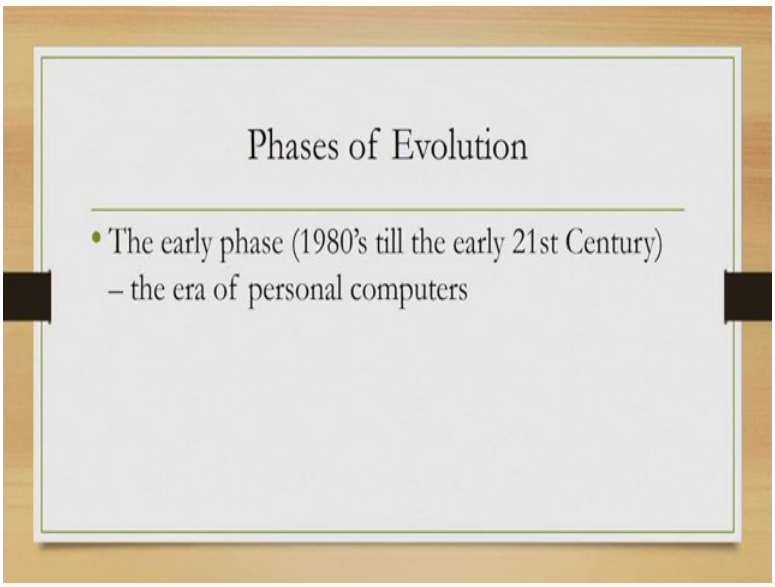
So, the historical evolution we can broadly divide into four phases; so but one thing you should note is that these phases are not unique; there are overlaps between those phases we will see that.

(Refer Slide Time 24:11)



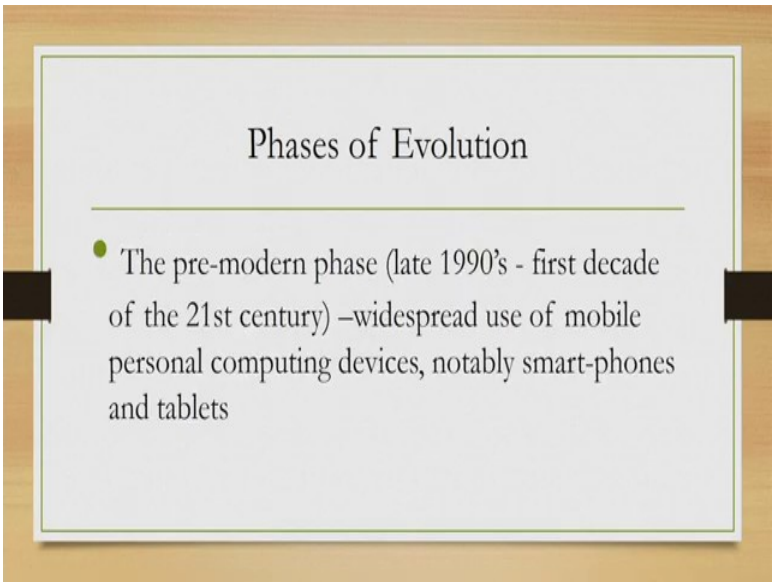
Now, first phase is the pre history that is before the advent of personal computer, we are calling it the pre historical phase between 1940s and 1970s of the last century.

(Refer Slide Time 24:24)



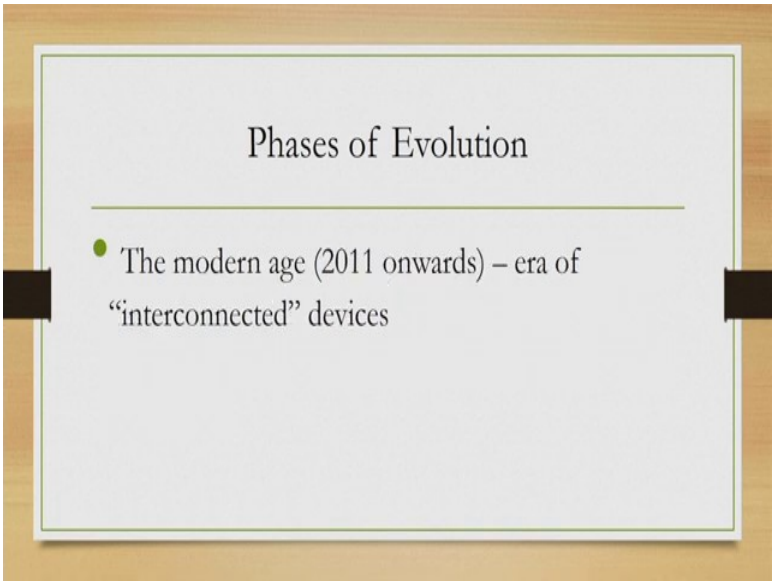
Then we have the early phase which is between 1980s and the early 21st century that is the first cut you can roughly say. During this phase, the personal computers particularly the desktops and laptops were used heavily; they were very popular all those the laptops as stealer.

(Refer Slide Time 24:44)



Then, we have the pre modern phase which started from late 1990s to the first decade of the 21st century. So, the early phase and pre modern phase there is certain overlap as you can clearly see. How we come to this phase? During this phase, there is widespread use of mobile phones, tabs, mobile; personal computing devices.

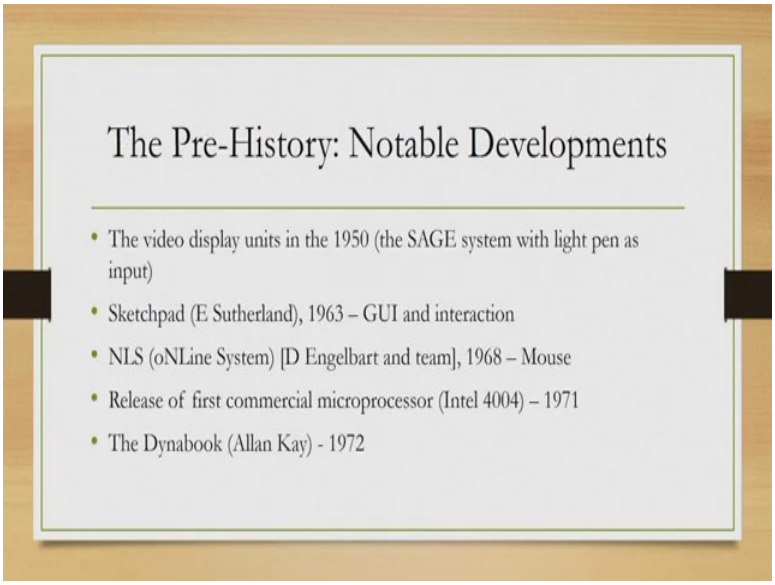
(Refer Slide Time 25:06)



And finally, we are in the modern age which is we can roughly say that it started from 2011 onwards, but actually it is not exactly that year, but roughly we can say during this period we have seen the proliferation of interconnected devices; devices that are

connected to each other. So, these phases sometimes you can say the phase of ubiquitous computing.

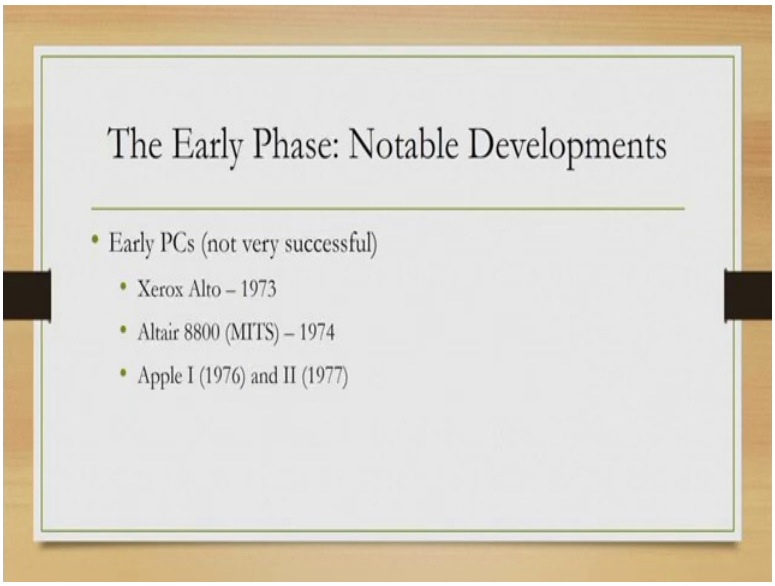
(Refer Slide Time 25:31)



In each of these phases, there are some notable developments which are milestones in these phases. So, let us start with the pre history. What are the notable developments? There are a few; one major development that happened in this phase is the development of the videos or video display unit one example is the SAGE system; SAGE; so that happened in the 1950s. In the 1960s, there are few important developments one of those is the sketchpad system developed by Ivan Sutherland which introduced the concept of GUI and interaction.

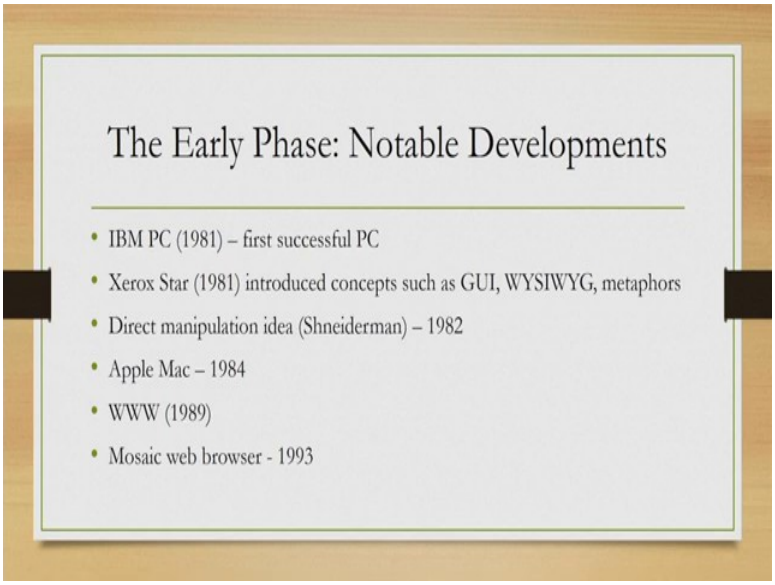
Then came the system analysts by Douglas Engelbart and his team in 1968; this actually introduced the concept of mouse. In 1971; one major event happened in that year the first commercial microprocessor was released it was Intel 4004. Now that of course, as you know the rest is history. So, that changed the way computers are made and that actually helped in popularizing computers bringing computers to the masses. And finally, we may say that there was another development called system dynamics by Alan Kay in 1972 which is a precursor to personal computer. So, in the pre history all these are the notable developments.

(Refer Slide Time 26:57)



Now, in the early phase which was characterized by the advent of personal computers; so most of the milestones are related to that only. So, there are some early attempts in making PCs which were not commercially very successful. Examples are Xerox Alto which came in 1973. Then Altair 8800 which came in 1974, Apple I and II which came in 76 and 77; respectively these were as I said not commercially successful products.

(Refer Slide Time 27:30)



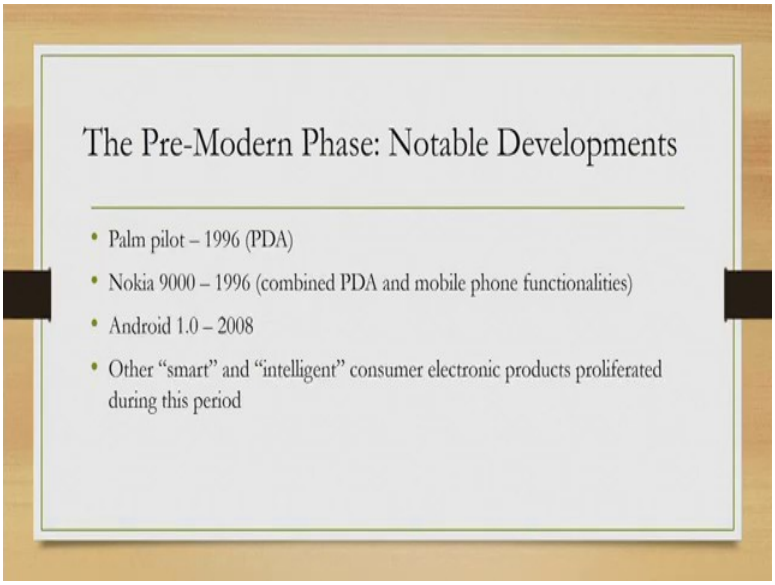
So, first commercial success came in 1981 with the launch of IBM PC and then in 1981 the same year when the IBM PC was launched; Xerox lunched product; Xerox Star

which introduced many important concepts that we are still using and which actually revolutionized the way humans interact with computers; such as the concept of graphical user interface, the concept of WYSISYG which stands for What You See Is What You Get and the concept of metaphors.

And in 1982; Ben Shneiderman came up with the idea of direct manipulation which again helped in popularizing computers among the masses, among the people who are technically not expert. Then 1984 saw the lunch of Apple Mac one of the very popular PCs, 1989 saw the introduction of World Wide Web: WWW and the Mosaic web browser came in 1993.

So, all these developments actually helped in popularizing the PC and taking the PC to the masses. Now people are using computers for things other than computing. So, for example, I can use it for sending emails, to be in touch with others and to create an excel sheet, to write a letter, to create a document many things which are traditionally not considered to be computation.

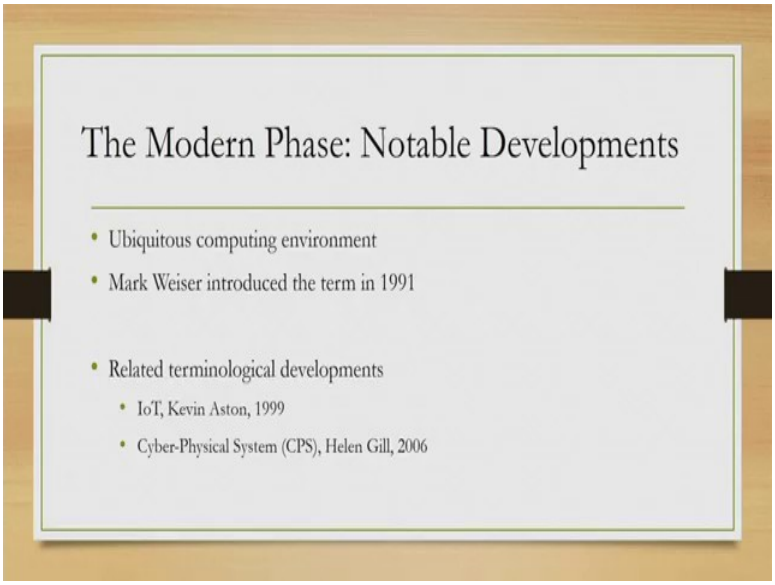
(Refer Slide Time 29:06)



Then came the pre modern phase where the mobile devices proliferated. Now first mobile device; the palm pilot which was a Personal Digital Assistant or PDA came in 1996; then Nokia in the same year launched the Nokia 9000 product which is a combination of the PDA and the mobile phone which can be considered to be the precursor to smartphone.

Now, we are all aware off android ways. In fact, most of the smartphones run on these ways. So, the; the first version of Android came in 2008 which is one milestone in that phase. Along with this specific milestones, the period also saw development of many smart intelligent products that are used in home such as the smart TVs, smart refrigerators, smart washing machines, smart ACs and so on which are as we have seen earlier computers, but which the people are using without knowing that they are computers.

(Refer Slide Time 30:22)

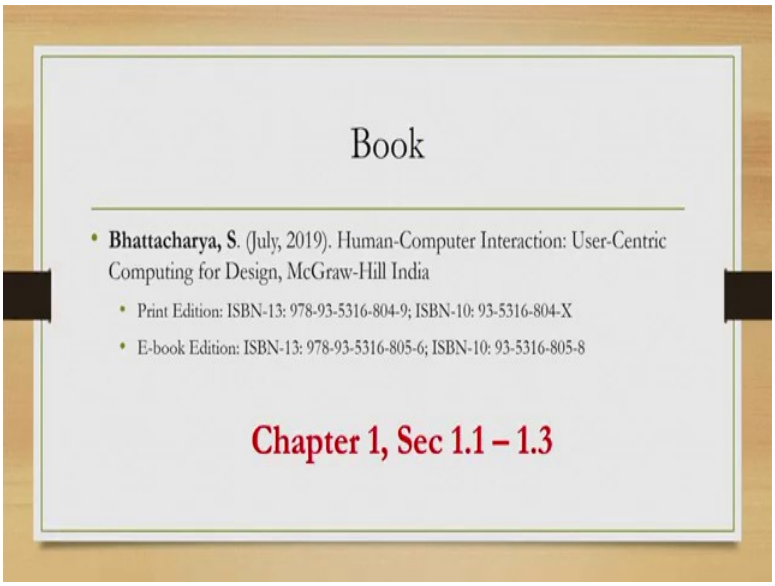


We are now in the modern age as I said before; now in this age the devices that we use are connected to each other. So, one with one device we can control other devices; this is called ubiquitous computing environment and the term was first coined by Mark Weiser in 1991. But there are some related terminological developments which are slightly different than the concept of ubiquitous computing and we will see the difference later.

So, one term that become popular is the IoT or internet of things by Kevin Aston in 1999. Then the other term that become popular is Cyber Physical System; CPS; it was coined by Helen Gill in 2006. So, all these terminological developments point towards the fact that we are actually the ubiquitous computing age, where multiple devices are therel they are they are connected to each other and they behave quote unquote smartly.

So, that is in brief the major milestones and historical developments that took place in the field.

(Refer Slide Time 31:44)



So, whatever I have covered today all the material are taken from this book; you can see this is from chapter 1 and section 1.1 to 1.3 of the book. So, you will get all the material here.

Thank you and goodbye.