

Human Computer Interaction (In English)

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Lecture 1 Part 1

Hello, everyone. My name is Dr. Rajiv, and I'm going to take course on human-computer interaction, in short HCI, as part of NPTEL. I'm going to be assisted by amazing teaching assistant Adarsh Pandey and Ritwik Bamba as part of this course. Human-computer interaction is not just a technology, but It is the way it connects people and the machines around us. As we know that we are surrounded by digital devices, machines all through our life.

For example, I am wearing a smart watch. It is now not just a smart watch but it is basically helping us in many other ways. It is helping me in getting the time. It is helping me in monitoring my health status, how many steps I have walked in a day and so on.

So if you see around your real world, there are many such examples which is around you, which you can think of part of human computer interaction. This is a very quick introduction about our teaching assistants, Adarsh Pandey. He is a PhD student in the Department of Human Centered Design. As you can see that his research interest lies around human computer interaction and he is using SCI technologies to solve digital health problem and he is also using physiological signals to solve the problem around health care. For example, he is working on a solution, how we can help a patient suffering from vertigo to diagnose even the person as at home.

Our another teaching assistant, Hrithik Bamba, he is a BTEC student in the Department of Social Science and Humanities. He is part of a very unique program, which is involving the concepts of computer science as well as the same in social science and humanities. And his research interest revolves around human-computer interaction, econometrics, statistical data analytics and so on. So you can also think that like, can we solve problems related to the finances using HCI? Similarly, can we use the problems related to say teaching, which as part of this course as well, can HCI technique can help us in solving in better ways. We are reachable at the mentioned email address.

And this is me, I'm associate and Institute Chair Professor in the Department of Human Centered Design and the Department of Computer Science and Engineering. And I also

head the MIDAS Lab at IIT Delhi and also head the TCS Center for Design and New Media. As you can see that TCS Center for Design and New Media primarily focuses on building interactions, building a better user experience using the advancement in design and new media technologies in the intersection of HCI, interaction design, AI, and so on. So my research interest lies around AI, human-computer interactions, the recent advancement that we have the large language models, natural language processing, and the speech processing. And if you see that, The human computer interaction that we have, the first part is human.

So we have to keep human in the loop. We have to keep human in the center. And that's where basically we also have to understand how human interact, how human do any work in their real life. One of the common thing that we have as part of any human, they speak. And the way they speak, they can utter the voice, they can write the things, they can communicate through gestures and many other ways.

So there are so many works around HCI which is working towards making the human life easier. So be it related to education, healthcare, about learning and so on. So here as part of HCI, we have to work towards how we build the experience, better user experience. And if you want to go one step ahead, then it's not just about user experience, but in corporate terms, we call it customer experience, where it is now just not limited to the machines or the device that you're interacting with, but it is also beyond that. So as part of this course, we will be keep discussing all those latest technologies that we will be studying as part of this course.

So this is a very quick introduction about MIDAS Lab. It stands for Multimodal Digital Media Analysis Lab. And as you can see that it focuses on multimodal data how we can leverage the multimodal data to solve different real-world problems around us. And as part of multimodal data, as you can see that we do integration and analysis of different modalities, including text, images, video, audio. Again, it could be any additional physiological signals as well.

And where basically we are using cutting-edge AI and human-centered computing or you can also say that human computer interaction techniques to solve the real world problem around us and I will be showing a sample work which we have done recently to start with to tell more about the Midas lab. Midas lab work very closely with both academia and industry around the globe and our students are not just working in the top companies, but they're also pursuing higher studies in the top institution in the world, including CMU, Harvard, Johns Hopkins, Georgia Tech, Cambridge, and many others. So the approach matters follows, to keep human in the center. And that's where basically Midas make impactful contributions to both human and industry through groundbreaking

research and the transfer of innovative technologies. And many of the work that we have done now being used by the different companies in solving different real world problems.

That includes behavior understanding, that includes how to make the movies accessible or probably reachable in not just in one language where it has been built but reachable to the audience of other languages so for example there are more than 20 official languages in India and thousands more unofficial languages and that basically a gap that we have in communication or understanding others and often we know that there are wonderful movies are being made in one language but how do I understand if I don't understand that language and that's where the area of you can say that video dubbing technologies which make movies from one language to another keeping the scene same but generating the voice in other language or even providing the subtitles and many others to help you out. So that is something we are working with different our partners. You can find more details about our lab at this website [midas](http://midas.iiitd.ac.in).

iiitd.ac.in and In order to know more about the research my lab and I am doing, you can also reach out to my Google Scholar profile as listed here. And as you can see that the primary research area that we have is around speech processing, how to make the conversation more humanistic, Natural language processing, because as part of this digital era, we leave a lot of digital traces in terms of text. So, for example, many of you might be on Twitter. Now it is called X. You write something and post.

Similarly, you also interact with different people or other social media. So that is something you can consider. Similarly, large language model, this is also one of the groundbreaking research is coming from OpenAI and Meta and many other companies, which is basically releasing a lot of, you can say, the research around large language model. So large language models, primarily about doing the next word prediction task, but they relate with different real world problem around us to solve problems related to what we face in daily life. So including, for example, can you help me in writing something around a topic? For example, an essay on what if I want to be a prime minister? What I will have to do and what I will do if I become a prime minister? So these are these kind of questions we often being asked when we were in schools.

And so as you know that, I mean, we have that technology advancement which help you in many other ways and the reason our lab focuses on multimodal computing because we try to keep human in the center and if you look a human closely, how does it work? A human basically as you can see a perfect example of multimedia system because as a person as a human we can see So that is nothing but kind of doing some kind of computer vision or image processing. We do speech processing. We communicate. And as part of speech processing, it is not just about speaking. It is also about how we speak.

So it has a lot of other characteristics that need to be considered as part of our study. A very simple example you can think of, I will kill you. So that is something you can say more in a funny way, but you can be angry and say the same tense, I will kill you. In a way, what does it indicate? Content is same, but the way you are saying is different and that changes whole meaning. So as part of, again, the study that we do, we try to basically work around these technologies and solve.

So as part of this course, I will also going through the different HCI related work that we have done. And that is something I will cover in the upcoming slides as well as in the upcoming lectures.

As I said, let's... Let me briefly tell about how our lab focuses on different real world problems. So if you recall during COVID, COVID has basically changed the way we live and basically it created a big chaos around us. It changes everything the way it was before. be it area of education, be it area of assessment, be it area of any government services. And that's where basically we have to see how we can find a relevant problem which is important to the society, to us, and we can make an impactful work, impactful direction for the people.

Towards these directions, we have started working over one of the major challenges we faced during COVID. As you know that conducting an online examination is one of the biggest challenge we face. And even before examination, if you see, how about the learning? Learning also get hugely impacted because the way Because the way we were dealing with all real class examinations or real class lecturing, we directly interact with the students. We can monitor them.

We can ask them. Even they can ask us any question they have. And similarly, in examination, they are our invigilator. We are following the examinations to conduct a fair examinations and so on. But in the real world, when the COVID happens, it has changed everything. Nobody can come out of their house.

Then how do you conduct the examination? And that's where basically we face the problem of cheating in online examination. So those who have watched a movie on 12th failed. I think this quote basically very clearly relates with that. Cheating is a choice. not a mistake and it trades short-term gain for a long-term loss what if Manoj Sharma has done cheating in the 12th exam then probably he would not have been IPS today but he followed the learning he has from the mentor he had and he decided to not do the cheating so though he fails in the 12th exam but he definitely succeeded in his life.

And that is the something we have to do. So as part of education, the whole purpose of conducting a fair examination is that you study, you focus, you learn and apply the learning that you have as part of the, again, examination is just a metric. Again, even any examination cannot fully capture the understanding of any student but that's how the education system works and that's how basically we have to complete the examination to rate the students grades it has other social implications so we are not going to that but let's get back to our problem of how can we detect cheating in an online examination so in traditional system often When cheating happens, as we know that there is invigilator who are basically following and looking at you and how you're doing examination and you don't have anything which you can do. You have only copy pen that you write your answers and it was fair examination often happens. But in real life, when COVID came, we moved to the online examinations where basically we started seeing often Though I can, again, so there are different systems try to handle this problem.

Often most of the people switch to MCQ based examination. And MCQ based examination is, based on my experience, is not the best way of assessing students. Often you require subjective questions and corresponding answers to assess the understanding of the students. And that's where basically if you move And also copying in MCQ based examination is very easy because based on real experience, often we see that the students from the WhatsApp group or many other such groups, they just pass on the answers and so on. Though you can do some thing to handle by randomizing questions and so on, but again, that will add additional logistic issues and also the examination may not be fair again for everyone.

So that's where basically as you can see that as part of online examination we need to have all kind of questions that ranges from not just MCQ but also subjective based questions where the person has to write answer, the person has to do some online coding and so on. So that's where basically as you can see as part of this exam, the person is quite happy. Happy because you can see the person is using a smartphone, writing the answer on the laptop he has and he's very happy. He's able to answer all the questions and so on. So that necessitates a requirement of having a system which can do a robust checking of if a person doing copying or not so that's where basically we have seen couple of system emerges that is talking about okay so we disable copy paste we will use the camera so that we can see the person and so on so again up to some extent you can find some cheating but again I would say that those who want to do cheating in the examination they are very smart they can figure out how to do the cheating.

And especially if you consider even the situation of, you can say that assignments, if you're given a task, you need to complete at home and submit. And often we see that especially after the emergence of large language models, what happens? People go to the

chat GPT and probably other similar system, give the question and ask, can you help me with the answers? with a fraction of seconds what will happen you'll have the answer and so on so like in this case one situation you can think of the person is uh probably given a question he just write on chat gpt to give me the answer since the copy paste is disabled he can't use probably the laptop to copy paste the answer but he can open the answer in his smartphone and He can start looking and start looking at the answer and keep writing. Right. So again, it's a very difficult case. It's a very difficult case because in this case, I understand it's easy.

You can see the person is holding a phone in his hand. So as a proctor, you can find out the person is cheating. But as I said, the students are those who want to do cheating are very smart. So their friend or probably someone else sitting behind, which is not in the vicinity of the camera, is showing the answers. And you probably you can basically look and there are many other ways you can do so.

And especially in assignment when there is no proctor, you can simply use the answers of chat GPT and others to submit. So how to detect those? So in that case, it necessitates some kind of online waste system, which should not consider the answer you have given, but it should also consider the way you have written. And that's where basically we come into the, you can say the area of behavior, understanding behavior, dynamics and so on. So as you can see that the problems with cheating in examination end up rising online education and JNU advancement.

That is one of the cause. It also increased because of the problem of contract cheating, idea adaptation and even the intellectual property theft, right? And content-based detectors such as Turnitin, it is one of the very popular plagiarism based system is not effective as we want them to be. So as part of this work, we wanted to basically build a system which can help us if a given text or written text is copied or it is written after a thought process, because I believe you can relate that If you have to just simply read and write, your behavior will be quite different. The errors that you'll be making will be quite different as compared to if you have to think about the solution and write, it will be quite different. So that is the motivation we had about this work. So this work titled Keystroke Dynamics Against Academic Dishonesty in the Age of LLMs.

This work has been done in the collaboration with my students and Professor Rajesh from Bucknell University. And this work has been published in IEEE International Conference on joint, sorry, this work has been published as part of IEEE International Joint Conference on Biometrics, in short, IJCB 2024. And I'm very happy to tell you that this year itself, this paper has received the best paper award for this work. And the aim that we have as part of this work, evaluate the effectiveness of the typing pattern captured

by the keystroke dynamics in detecting intelligent and gene AI-assisted plagiarism. that is the work we have done and one key thing you can see here the keys it is based on keystroke dynamics what is keystroke dynamics keystroke dynamics is basically one of the you can say the behavior that people do it's basically the part of behavior understanding as you can see that the way you are writing is very different as compared to and it is different for different people and so on so like as you can see that keystroke dynamics is basically a human typing rhythm on digital devices as you can see that the person is writing on laptop this will be very different as compared to when the person will be typing on say smartphone or tablet and so on And again, the different person writing on this laptop will be quite different.

The typing pattern will be quite different. So it is not just about what you type, but also how you type. As part of keystroke dynamics, as you can see that we collect different data for the different keystroke event is happening. There are two primary keystroke event we capture, key up and key down. because whenever you press any key so you basically do the event key down and when you release your hand it's key up and if you capture the time stamp for that you have a lot of details about the person how the person is writing so like in this case the person is writing the word Delhi as you can see that here the person writing for Delhi So that includes the letter D-E-L-H-I. So in this case, you can see that the user one basically first press D key down event is happening and you capture the timestamp.

And when the person release the key, the event happen is key up and the letter will remain D and in a way you have another timestamp so if you make a difference of these two timestamp you get to know that how much time the person has taken to write D right and similarly you can do that for and these are very very important information based on our research and other experts who are doing in this area and shown that the way you write the way you type, the way you swipe, the way you use your phone. So this overall area called the behavior biometrics. So here we are basically capturing the biometric details of the behavior of the user. So in many past work, we have seen that based on this behavior biometric, machine learning based models are able to tell you What is the age group of the person? What is the ethnicity of the person? Whether the person is white or black and so on. So again, a lot of research work around this are happening because the way you type your behavioral biometric data is basically cues for system to understand more about you.

So that is something we have done as part of this work. And as I told you, like writing is a very complex, nonlinear and goal driven task because you are writing something. Often you have some knowledge, little knowledge, and also you have to apply all those knowledge to basically think about the solution. So writing basically involves three

components. So task environment, writing process, and writer's long-term memory.

So Hayes and Flowers proposed a very interesting, you can say that writing process model. So as part of this writing process model, they have told that so when you have to write something about a given topic or something, you first start thinking about it, right? So that is you start doing idea generation, task preparation. So proposer basically starts gathering information through past knowledge or probably the even the environment where you are and so on so for example if i ask you what do you want to achieve you in your life question remains same but i bet you if i give you two different environment the answer will be different right so it also quite dependent on the task environment. So for example, you are sitting in the bank of river around the hill, outside the lake, probably you'll have different answer for the question I ask as compared to when you are sitting in crowded area in a city or in a education institute and so on. So once you gather idea, you start doing task preparation, next step is basically you want to convert your ideas into language so that's where basically you start writing about it and once you start writing it's the way people are writing often some people write very fast some people write very slow and also you may tend to make mistake so like in this case as part of next stage You do spelling, grammatical accuracy, immediate corrections and all that is something in the words and probably in sentence as well.

So once you have done that, what is the next step? You review what you have written, right? You can relate whatever I'm saying with the way you write, because once you've written, you can also review whether you have written an answer, what has been asked. If you don't review, what will happen? you end up basically doing something or writing something which has not been asked. Again, let me give the example of 12th fail. Manoj Sharma failed in one of the written examination because he was confused between the word terrorism and tourism, right? So that is the reason it is very, very important to review what you're editing and for that basically you do a lot of extensive editing signal jumps and so on and You basically complete and one thing you can see that it's a cycle and it's basically in a way It's a never-ending cycle because you can't come up with a perfect thing So often you limit that by some constraint what those constraint could be it could be the You need to write your answer in say 200 words, 500 words and so on.

Another constraint could be the time. You have just 10 minutes to write the answer and so on. So in a way, I mean, you make the compromises and using this trade-off, you complete your final answer. So problem statement for this work. And the reason I'm emphasizing on this work a lot, because I do expect after the end of this course, you will learn the different human-computer interaction techniques.

You start working on different real-world problems. And those who are interested can

even pursue research around SCI. And you can, again, you can work with our lab, MIDAS. There are many research labs around the Globe and also in India you can also work with them to work on a problem So let's get started with this work So we are basically the problem statement is given two keystroke patterns k1 and k2 collected during bona fide and assistive answer typing develop detector as follows So here is the detector D, which can tell you zero means bona fide, one means assisted. So the summary for this work is, so the summary for this work is, detected Gen-AI-assisted academic dishonesty using the keystroke dynamics as I told. Collected keystroke data during bona fide authentic and EIS-assisted writing task.

Implemented and evaluated type net based detector under user, keyboard, context, and data specific and agnostic scenarios. And we are able to achieve the accuracy. Again, accuracy is one of the metrics. There are many others are there that you can consider. And it ranges from 74% to 85% under different conditions and scenarios.

Okay, so let's get back to the real SCI. As I said, SEI is not just a technology. It is beyond that. It connects people with the different machines around us, different digital devices around us, and it tries to make the experience enjoyable, fun, and of course, complete the task, achieve the goals that you have. So as part of this course, we are going to consider different techniques which are going to help you in achieving the same. So we are going to study about how the human basically achieves something using the different devices they have and whether the task they have completed, is it just completing or the person is also enjoying and so on.

So this is the outline of the course. This is the outline for this lecture. So we are going to study about why do we need to study design? What is human computer interaction? What is if we have to build a HCI project? And towards the end, you'll also have basically two sample HCI projects that is discussed. Some of the topics may be overwhelming in the first place itself, you can say when you start the course, but you don't need to worry about it because all those topics you will be studying over this course and you are expected to basically complete similar course, similar projects towards the end of this course. And we'll be also having tutorial and assignment as a weekly work.

So this is the overview of this course. We start with what is HCI introduction? What is design? What is interaction? Because in a way we have to finally work with different devices. And how do you work with different device? You have to interact with them. What are the different interaction is happening? User perspective because there are different stakeholder for any product that you have. and these stakeholders may have different traits, different attributes.

That is something you need to keep in mind, different capabilities. Similarly, interface. So interface is something that you basically interact with any machine and that is the first thing you get work with. So for example, you have a website. So there is a website, there are some different buttons and you basically play with them to do your task.

We'll also work towards the data requirement gathering and analysis. And next we'll be going for prototyping and smart UI because we have to see how our idea is getting converted, how our idea is getting translated into a real project. So in a way, In HCI, what we start with, we start with conceptualizing a solution. Then we basically, after conceptualization, basically you start building some kind of, you can say the twice solution, which people can interact. So different prototyping techniques and different prototypes will be studying, ranging from low fidelity, mid fidelity, and high fidelity prototypes. And we will be going through the iterative design and the evaluation because evaluation is one of the key component of assessing whether a solution that you have built fulfilling the requirement it has to, whether it is completing the task it's supposed to do.

And how good is that? How good was the experience? Going forward, we will be basically We're going for the more advanced techniques, advanced technologies, where basically we are working with HCI with IoT, HCI and AI, privacy security and HCI, and lastly HCI and AI-based conversation system and applications. As part of this course, we also want to provide a hands-on experience with the popular tools and the software around HCI, which will help you In coming up with the project that will be showing as part of this week, you can build something similar. So Adobe Express, Canva, Figma, Miro, Behance, Adobe Illustrator, Firefly, ChatGP and many others will try to cover as part of this course and so on. and the course objective for this course. And that is something I'm looking forward and I hope students will be able to discuss and distinguish human-computer interaction, user experience design, and design thinking as part of this course.

Moreover, they will be able to apply user-centered design techniques for gathering data rapid prototyping as well as conveying the design concept we learn as part of this course and they should also able to assess the usefulness and the usability of the interaction design how usable the solution is how usable the product that you have built and so on and finally I hope that you will be able to ideate prototype and evaluate new design concept as part of the any project that you'll be doing these are the reference book again our lectures and probably the teaching will not just limited to this book there are many other resources but these are very good resource textbook that you can go for getting more detailed in-depth understanding of the topic so let's get back to why do we need to study design as you can see the these examples what do you think both look similar as

you can see here it's a canola cooking spray so it's a basically kind of oil that you use for cooking but if its design is very close to you can see that a fly and insect killer so for example you are going to d-mart walmart or anywhere where basically if both of these items were together nearby and even if they are far apart you buy both and by mistake when you put when you bring this at your home you start cooking with fly and insect killer instead of cooking oil and what will happen then you end up going to hospital right similarly here in this case of fire please find somewhere else to put it out because so probably this railing has been built after the hydrant was there so instead of removing this hydrant from here the constructor decided to just build in this way, which is of no use. You can't use hydrant anymore. In this case, you can see that a baby has born, probably in between this date, and it has a zodiac cancer. But again, as you know that we fear from the word cancer, right? So you can't have a message like this, congratulations, you have a cancer, right? So that is something requires not just giving the message, probably it has to be done in a better way and so on.

So you can also see many more examples mentioned at this level. So let's get back to our real life. As I said, in real life, we interact with many websites, government website, ranging from government to or any other services that we are availing.

So let's go to one such example, passportindia.gov.in. And often we hear that the government websites are not up to the mark and you are probably basically see here how good or bad it is. There are of course some good things. It has many interactive features.

Contents are quite organized. and new information is highlighted. That is good. But there's something that can also be improved. So menus are not intuitive. There are too many text colors, right? You can see here, it's confusing.

And too many details. So it has a lot of information. It is very hard for any user to find out what they're looking for. Let's see another example, mcdonline.nac.in. As you can see that this screenshot has been taken on November 16, but it still has some outdated information for this.

So that could be probably improved. Some feature doesn't work. and probably for accessing some services you need to probably go to some other website like do you wish to continue you are moving out of this of course i don't want to move you need to provide everything on this website itself i'm coming to your website at the same time it has many good features and so on so there is always a trade-off you can't have a perfect world but at least try to make it a perfect world another example you can see here eci.gov.in of course it has interactive feature contents are quite organized you can see that it support Hindi as well it support Hindi as well new information is highlighted as you can see that

somewhere here and so on and some thing that could be improved if you are having any feature on your website it should work so like in this case when I tried A plus, A minus, it doesn't work.

Too much space for poster. Too much space for poster as you can see here. And very little work, very little space for probably the important information that you could have shown. So menu hides all key tabs it has, and it does not support many Indian languages. So, though it supports Hindi, but is it enough? Because given that Election Commission of India conducting election in all states and many people does not understand neither Hindi nor English. So, how you are going to help them? So, these are something, I mean, we have to study.

Why we need to study design? Because you can fix all the problems we have discussed here. And If you look around in your real world, you can start thinking about things. And that is the beauty of this course. Whatever you study, you start directly relating from the day one. So, for example, we are talking about bad design. So, start looking at have you encountered any bad design in your life? If come across bad design, of course, it will encounter bad.

some problems so what problem did you face of course based on those problems you may have some experience and if you face problem then definitely you will have bad experience and have you ever thought about the solution often we also come up with the solutions for those problems we are facing when you come up with the solution is it the optimal solution it may not probably many times we just make a makeshift solution which may not be enough so we should start working towards how to find the best solution and how to ensure that your solution solves the problem indeed you have to do the evaluation and is your solution perfect probably it may not because again there is no nothing perfect in the world you have to basically keep improving and that is the basically one of the key concept in human computer interaction is iteration keep doing this iteration keep building a better solution that what you had before and so on and that's where basically you start working towards everything will be okay in the end if it is not okay then it is not the end right so you keep working towards this building the solutions to get it done so one thing is very important to know that what to build how to make a good design because as we discussed what are the good things and not so good in the website that we have seen It is very hard to know that what to do, how to make it better, but it is relatively easier to follow what not to do. So if you follow this indicator of bad design, I think you already achieved a major milestone. So what you have to avoid? If you have a confusing navigation, you see users struggle to find their way around, cannot easily locate any feature. So for example, given a kind of passport website, if it is very hard for me to find where to book the appointment for my passport, how to do the renew

of my passport and so on, then I'm going to have bad user experience. I will start complaining about website and so on poor feedback often the system doesn't clearly indicate what action has been taken what happened so for example often when you click any button ideally you should be able to see the button has been clicked either through the sound or at least some visibility should be there to know that what is happening similarly loading indicators when you for example download some video from internet, it's showing, okay, so how much progress has been done, 10%, 20% and so on.

Because if it will not show you indicator how much has been done and how much time it will take, I think you don't know how long you'll have to wait. And again, that leads to a bad design and bad user experience. And similarly, other things you can see that inconsistent design elements. So different layouts for different pages, different colors, different styles Very bad experience.

Overcomplicated interface. So you have cluttered screens, too many options, unnecessary features. It basically simply over blames the user. If you see the real world around us, so when you start going through these topics start relating with the real world problem that you face whether it has confusing navigation, poor feedback, inconsistent design elements, over complete interface, lack of accessibility. So ideally the system that you are building, it should accommodate all kinds of users. It should not limit someone, right? So design does not accommodate users with disability and diverse needs. So that is not good, right? doesn't matter I know Hindi or English, when I interact with election commission office, I should be able to get the information.

Similarly, whether I can read or not, simply it should not basically bar me from accessing the information. So ideally as part of this human centered design, and the design principle that we'll be following. So ideally your system should be quite simple, easy to use, easy to learn. inefficient workflow so task requires too many steps or combustion or cause frustration so for example if the same task can be done in just one or two clicks you should not make it probably five or six or longer so you should always try to minimize the number of clicks to achieve the goals one of the biggest e-commerce companies we are aware of called amazon you know what makes amazon so big they came up with a and it's not like amazon was the first company which has selling products online there are many before but what different they did they basically came up with a patent one click ordering so where basically you can think of if you want to buy any item with just one click you are able to have it Similarly, next you can see that unclear instructions, so labels, buttons, actions, if they're ambiguous, that leads to bad user experience, you should not be able to, you will not be able to complete the work and that leading to confusion about the purpose. High error rates, lack of aesthetic appeal and so on, these are other indicators you should work when you have to basically what not to do.

so these signs basically can reduce user satisfaction and if it will reduce the user satisfaction that will lead to the causing frustration and what if you will get frustrated while using the system you simply discourage continued use of product or a system and that is the least thing any company want you to do any company which is we see they always getting bigger because they have to retain their customers they have to retain their users right if they will having bad user experience they are not satisfied they are frustrated why they will use it there are so many other alternatives there are so many other products they will start using it so let's get back to the user study of case study where you can see that In real life, often we see one of the big problems that we face is remotes around us. Often it was one of the major issues personally I also face when I go to some friend's house, there are different keyboards, there are different remotes and so on.

It's very hard to interact with them. It's not that intuitive. It's not that simple. So around that, let's think about and ask the same question that we had. Have you encountered any bad design related to remotes? What problems did you face? For example, it's very hard to figure out for me how to use it. Keyboards are very small to use it. is a lot of functionality which I'm even I don't understand what they are so you have experienced some good some bad and have you thought about the solutions what if you would have to make the solution what you have done is your solution optimal again if it is not then what is the best solution And again, if you come up with the solution, you have to ensure that the solution solves the problem indeed.

So for example, in this case, one solution could be, I want to open Netflix. So if I click the Netflix button, ideally the Netflix should open, right? And so on. Often when we are coming with a solution, often we, may have some bias, we may have some assumptions, like one assumption you can think here. It is assuming that the user of this smart TV, they will definitely have Netflix. Why? There are so many other companies, there are so many other solutions. Why should I have the Netflix? But again, there is some reasoning behind using they have the Netflix and that is something we have to think about.

Another case study you can think of crash test dummy. So what do you see here? So it is basically two male hybrid three crash test dummies inside a kind of one of the crash test. What does this indicate? Can't a female be one of the passenger? Can't female be one of the driver? If we study the body structure of the male, female, kid and many other people, old people, young people and so on, all are quite different. So ideally, when we are doing any kind of the problem that you can identify here, you have to basically study not just the carcass of the two males or just males, but also the other people.

Again, you can think about the solutions around this. Similarly, visually impaired person crossing the road. It's very big problem probably for a visually impaired to cross a road, especially in areas where people don't follow the traffic rules. How do they cross the road? From the picture, probably it looks they have very clear zebra crossing. All the vehicles are waiting for the person's to cross the road, but in real life, it is not like that. Similarly, you can think about what all the points we discussed, does it have any bad design if you're coming with the solutions and so on and how to come up with the best solution, how to come up with the perfect solution and keep iterating over the solution that you are building to come up with a solution that at least you can call it perfect.

Similarly, reading books. And again, we can list down numerous such applications, solutions around real life. For example, in this case, you can see that the lady is reading a book. But now, how many of you carry books? Very few. People start moving from, you can say, the reading physical books to the reading books on laptops, mobile and so on.

Right. Can you have the same experience? Is it the same? But it's not the same. And that's where basically when you are coming up with a solution, you have to think about how to make it better, how to make the experience of a reader similar to when the user reading a book, reading a physical book. So that is something you have to see. I mean, as part of your solution, you can think of. So how to have basically the bookmarking, how to highlight some particular text, how to basically find something, how to basically you can say the structure, the book, how to structure the content.

how to find some content in the book. So again, when you are building a solution around reading books, you have to basically come up with this. And again, you can iteratively keep building the solution around it. Similarly, exercise in gym. There are so many novice young people started going to gym influenced by the, you can say, the Hollywood star, Bollywood stars that we have.

After looking at such a body, they say they will also go. But that may end up with some accident. That may end up with some hurting themselves and so on. So how about coming up with a solution to make a personalized gym training based on, again, different bodies, different, different, the capability of the different people are different. So how you can basically build some solution for that. We all know that, I mean, how booking happens before, though it happens still like that, where you have to book, for example, a Tatkal ticket, there is a very, very long queue. And as you know that often for popular routes, the tickets just sold out in just one minute itself, right? So if you are in queue, even the second, third person may not able to find the tickets.

that's why basically the online solutions by IRCTC and all things are coming which help

you in booking online solutions so in a way everything that we have shown so far in a way that is some or other way it's interactive in nature websites you are interacting similarly mobile apps similarly I mean Any wearable based system smartwatch that I mentioned in a way you are interacting So what is interactive system interactive systems are computer-based system designed to facilitate? interaction between human and digital interfaces of devices So these systems enable users to communicate communicate our need or probably What we want control applies take some actions, manipulate data through various forms, input or receive near immediate feedback and so on. So the goal of interactive system is to create seamless, it should be seamless, efficient user experience and it should align with the user's need and objective because you should not end up building something which user doesn't want. You have to build what they want and probably you have to work toward making that experience good. So the key characteristics of interactive system include user-centered design.

You need to keep human in the center, user in the center. You need to consider the limitation, capability, understanding, constraint while building the solution. You need to provide real-time feedback giving real-time feedback, help the user understand something is happening. So for example, when you start booking a kind of Tatkal ticket, as I mentioned, it shows, right? It is progressing.

Your ticket is in, please wait for that. Bidirectional communication, adaptability, engagement, usability, et cetera. So examples include website, mobile apps, GUIs, touchscreen interface, voice assistant, Many of you might have interacted with Alexa, Google Assistant, Siri and so on. Online video games, right? Virtual and augmented reality, interactive data visualization tool and so on. So interactive systems are, that is something now being part of our life and we have to start working. So let's do one activity. Can you think of any digital interactive product that you use in your daily life? probably you can think something other than what I mentioned.

One example could be maps, digital maps, or probably many other things you can think of. So start evaluating how usable they are. So for example, we are talking about, for example, let's talk about the voice assistant based system that we discussed. usable they are are they able to complete the task we ask them so for example if you say alexa alexa please play this song if it is able to do that's good but it's not many times happening because often the voice assistant based systems are built on the native speaker of English they understand English well but if other speaker are saying the same it may not able to recognize what you're saying especially if you go to the other languages especially if you go if you talk about the voice assistant based system so for example Alexa probably they work quite well for English speaker because their voice recognition system is based on the native English speaker, but it may not work quite well for other speakers such as

Hindi, Bengali or other Indian languages, because that is not something they might have seen a lot. They're not working quite well on that. It also ranges from not just the language, but it could also with the way you speak because old man probably may fumble while speaking.

The pronunciation of a kid may not be very clear and so on. So you need to start thinking about how usable they are. Is it easy to use, effortless, enjoyable to use? And similarly, you can take one example and discuss what one change if we have to do to make it better usable, enjoyable, easy to use and effortless. And to achieve this, we need to be able to understand how to reduce the negative aspect such as frustration, annoyance and so on. And how you can enhance the positive ones. So for example, efficacy, enjoyment, efficiency, and so on.

So let's talk about our favorite example, digital voice assistant, how usable they are. As I briefly mentioned in previous slides, probably it may not work for non-native English speakers. It may not work for probably the young kids. It may not work for probably the old age people. So what if you have to do to do this? similarly as you can see that i mean the range of solutions from google assistant alexa siri and so on and you have to basically start working towards this direction so you can try to ask the same questions in the different example that you have so you have apple map google map probably there is ola map and many others which are there how how good the experience that you have with different maps, especially when there are traffic, especially when there are route changes. What kind of experience that you have when you use a faster route available? Similarly, what if you have a faster route available and so on? So you can do a lot of setting, different solutions have different ways of solving these problems.

Similarly, the digital payments app, you can think of Paytm, PhonePay, how good they are. There are many others. Are you able to complete the task you're supposed to do? How good was that? How easy was that? How effortless was that? And so on. So one example probably I can give, when Google Pay has been launched, we see a lot of failure rate. And in fact, all many apps, they show what is their failure rate. So ideally, those failure rates should be quite low.

But in the beginning, probably for Google Pay, it's quite high as compared to other partners or other competitors they have. Another very good example close to my heart is running app. There are so many running enthusiasts. How you can probably come up with a solution which help you in running by achieving your goals setting up your goals and there are so many but there are so many existing running apps are there but how good they are for the people with disabilities so for example a person who is visually impaired they can also be running enthusiast how can you help them in running so that's why

basically a very popular project called google project guideline as part of this project as part of this project as you can see that a visually impaired person he is also entrepreneur able to run independently again based on the different advanced technology that you are using using the probably the headphone there are some camera which is mounted in front of him and basically that do image processing to tell okay So this is the probably this is the line something you have to follow and that's where something running app you can build which can not use by the probably the common people that we usually see but also a people with disability can easily use it and achieve their goal. But again there are many technological challenges as well as you can see that here you can very clearly see that this is the direction you have to follow but in real life it is not like that. pedestrian way and many others are often they are occupied similarly the running track often occupied and often due to non-maintenance or due to rain even these lines maybe disappears so how to support that again so all those challenges they are working on but at least they are making great progress toward this digital travel app which i mentioned in in the past people were standing in the queue at the railway counter ticket counter to book the tickets lot of struggle people has to face but now with the you can say the advancement technology so now we have IRCTC make my trip this kind of application mobile applications website which help you in achieving the goal in better way and basically they are solving many of these problems they may not be perfect and that's where I urge you to basically think about what else you can do to make it better.

Similarly credit card payment as you can see that credit card is like you have the fixed date you have to submit the payment by this date often people tend to forget so there should be something which should remind you these are the due dates you have not done what is the minimum payment at least you need to make and so on so that is all thing you can think about as part of credit card payment activity that you can think about so that is we are talking about credit card payment and think about it how you can make it better what if you have to build a kind of credit card payment mobile app which closer to the real life the way people make the payments and is not just about the payment but it is also about how you can make it more easy effortless probably enjoyable fun and so on and you have to think about how to reduce the negative aspect so that while doing the payment the user should not face frustration for example you are trying to pay the bill but it is getting failed due to whatever the reason you are trying to You are trying to basically make a partial payment because you may not have full amount at this moment. At least the system should be able to make that happen. So you have to think all those aspects which user wants. And so that you can improve the user experience and the user should not only able to complete the task, but complete in fun, enjoyable and happy way. With this, this is the end of part one. So soon we will be meeting for part two of this. Thank you.