

Human Computer Interaction (Hindi mein)

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IoT and HCI - Lecture 9, Part 1

Lec34

Namaskar sabko main sabka swagat karta hoon yeh week saptah nauvein lecture mein yeh first part hai jo aaj main aapke saamne prastut karne ja raha hoon nauvein saptah ka. Dr. Abhijeet Mishra from IIIT Delhi Human Centered Design Department ki taraf se yeh lecture aapko main prastut karunga. Mera area of research Human Computer Interaction, haptic, VR, tangible interface, novel sensing, interaction design yeh sab mere area hai. Khair abhi inki zaroorat nahi padegi aapko samjhane ki kyunki yeh this is a overview lecture about HCI with IoT and applications case study. Start karte hain ab apna lecture. Sabse pehle main aapko batana chahunga hamare is poore course ka agenda kya hai? Hum kya-kya kis-kis areas par pehluon par hum baatein karenge. So pehla area hai Introduction to HCI and IoT. Hum discuss karenge iske upar. Hum janenge HCI kya hai? IoT kya hai? Inka role kya hai? Significance kya hai? Inki applications kya hai? When both the things are get combined together. Jab dono ek saath milte hain. Kaun kaun dono? HCI with IoT and challenges bhi hum usko dekhenge. Then hum aaj ke ubharte hue trends ko dekhenge and future directions bhi hi bhi hum discuss karenge. Phir main aapko apne hi kuch projects ki case studies ke roop mein aapke saamne prastut karunga ki what kind of ki woh kya enable kar rahe hain. Kya kiski kis cheez ki kami ko poora kar rahe hain. Woh projects main aapke saamne rakhunga. Usmein pehla project hoga Hapty Track aur doosra hoga Movie Tangibles. So again main aapka swagat karta hoon is lecture mein. Ab hum lecture start karne ja rahe hain. So pehla point aata hai what is HCI? HCI hai kya? There are bahut saari definitions exist karti hain. Agar aap online dekhoge offline padhoge kahin bhi padhoge aap aapko bahut saari definitions aapko dikhengi jo aapke saamne exist karenge for HCI. Sabka ek alag-alag tarika hai batane ka HCI yeh hai. Koi ek direction mein baat karega, koi koi ek direction mein baat karega but rather than main aapko yeh definition padh ke sunaun ki HCI is the study of designing interfaces for effective human interaction. Poora matlab HCI ka bas itna hai ki kaise ek human ko ek interface se kam time mein uska kaam hum woh poora kar le jo bhi kaam for example rail ticket ki booking kisi ko karni hai. Do interface hain uske paas for example MakeMyTrip doosra EaseMyTrip EMT. Is interface mein ticket book karne ka time lag raha hai 10 second. Is interface pe ticket book karne ka time lag raha hai 5 second. So aap is baat ko samjhein aapko yahan 10 second lag rahe yahan 5 second lag raha hai. Toh maybe yeh ho sakta hai ki aap dono mein se koi sa bhi interface use karte rahein. Aap lage rahein. Kabhi aap MMT use kar rahe hain. Kabhi aap aapko pehchan mein nahi aa raha ki main EaseMyTrip use

karoon ya MakeMyTrip use karoon. Abhi main uski baat bilkul bhi nahi kar raha ki aapko kya offers mil rahe hain. Main yeh maan raha hoon yeh dono hi platform aapko koi offer nahi de rahe. Yeh bas ek ticket book karne ka ek madhyam hai. Abhi aapko yeh 5 second mein karne ko de raha hai. Yeh 10 second mein karne ko de raha hai. Ab now you see aap apni daily activities mein rozmarra ki life mein aap kitni app access karte hain. WhatsApp karte hain. Right? Amazon karte hain, Facebook karte hain. Right? Even Google interface aap bahut saara enable karte hain. Aajkal ChatGPT bhi aa gaya. ChatGPT bhi karte hain to write to get some content. Wahan se kuch agar aap socho har ek interface agar aapke liye bahut hi bura ho aur aap har interface mein ek person woh koi bhi ho sakta hai. Right agar woh har ek interface pe 5 second laga raha hai toh kitne interface se woh deal kar raha hai ek ek din mein for example 10 toh 5 second multiply by 10 second 10 interface equal to 50 second. This is seconds and I am sure mujhe poora vishwas hai yeh seconds nahi yeh minutes honge aur maybe much more than maybe hours ho sakte hain five hours. Right this is for one person per day. Now 365 days in a year multiply by per person agar woh 1 ghanta bhi agar woh barbaad kar raha hai just due to bad interface right. Toh woh apne life ke 365 ghante barbaad kar raha hai. Abhi kahan se is HCI interface ki shuruwat hui? Abhi maine aapko example diya interfaces ka ki agar ek interface agar humans ke involvement se nahi bana hai toh yeh zyada chances hain ki woh interface at the end jab woh market mein release hoga. Yeh interface software bhi ho sakta hai in the form of app. Yeh software hardware bhi ho sakta hai in the form of haptic or device or tangible interfaces right. Toh obviously woh humans ka kaafi samay khayega. Pehli cheez woh khayega pehli cheez. Doosra usse kitni cheezein aur impact karenge uske kaam ko lekar ke uska hum andaaza bhi nahi laga sakte. So evolution kaise hua? Yeh aaya kahan se? Sabse pehle CLI simple logic based interface there was right? Jahan par aap keyboard mouse bhi nahi tha. Us samay aap textual command dete. Woh 1945 ke aaspaas 1955 ke aaspaas ki yeh baat hai. Theek hai? Wahan par aap bas just computer evolve hi hua tha. Woh market mein just aaya hi tha. Wahan par aap is tarike ke manual inputs aap de rahe the. Textual de rahe the, keyboard de rahe the. Mouse ki koi baat nahi thi. GUI aa gaye, mouse aa gaya, keyboard already hai because it allows aapko allow karta hai ki aap enter kar sakein. Textual form mein content aap enter kar sakein. Right? Then aap natural user interface now aap market mein aa gaye hain. Natural user interface matlab ab aap hand gesture se aap you must be if you are having a smartphone you can easily aap usko aasani se band ya open kar sakte hain ya face se aap usko control kar sakte hain aur bahut saari command de sakte hain. So yeh sab natural interface ke roop mein prakashit ho rahe hain. Right? Ab aap yahi dekhein yeh interfaces kaise evolve ho rahe hain. Kyun evolve ho rahe hain? Aap iska andaaza khud laga sakte hain. Kyunki hamare hamari device ka size bhi change ho raha hai. Hamare device ke use bhi change ho rahe hain time ke saath. Isliye hamara interaction bhi in devices ke saath change ho raha hai. Yeh hona laazmi hai. At the end kyunki pehle ek computer hua karta tha. Multiple people usko access kar rahe hote hain. Aaj computer ubiquitous ho chuke hain. Ubiquitous ka matlab hai aapki jeb mein computer hai. In the form of maybe iPad, iPads, smart earphones right, smart specs, smartphone and you can count as many as devices which are coming in the market. Aap dekh sakte ho kitni saari devices aa rahi hain which are computing

interfaces. Got it? So starting jaisa maine aapko pehle bataya ki 1940 ke aaspaas iska start hua tha. Logon ne dhyan dena start kiya. Logon ne seed boya. I would say. Main kahunga logon ne seed boya. 1940 ke aaspaas. Kaun kaun aadmi tha jisne seed boya? While there were many the most influential person was Vannevar Bush. He explicitly mentioned in one of his article that article name as As We May Think which you can find aap usko aasani se paa sakte hain online and you can also read ki iska inhone inka Vannevar Bush ka imagine kya tha imagination kya thi us samay 1940 jab computer the hi nahi computer bane hi nahi the. Us samay woh kya soch rahe the? Aaj ke daur mein hamari technologies ne humein kya kar diya hai? Physically disable kar diya hai. Technologies are doing lot of work. Unhone 1945 ke aaspaas imagine kar liya tha ki kaise hum logon ki intellectual abilities ko badha sakein. Agar hum unko access kara dein data ka. Kitne saare kaam log kar sakte hain. Us vision ko lekar ke ab aap agar aap is vision jo maine abhi aapke saamne rakha Vannevar Bush ka agar aap isko isko dobara agar thoda manthan karein agar aap sochein aapko yeh pehchan mein aayega ki Vannevar Bush ne jo yeh statement boli hai ismein human ka involvement unhone rakha hai. Unhone bola hai ki human ke liye human ke liye that means he was thinking that ab humein ab aap sochiye yeh daur tha World War First right World War First yeh daur tha and unhone World War First khatam hone ke baad hi yeh vision rakha ki bahut hua innovation in the category of designing variety of bomb. Right? Because us samay winning losing they are this is a very big game for any country right. But apart from that unhone bola apart from this is kind of innovation scientist researchers ko yeh bhi ab sochna padega kaise hum peace ko kar sakein peace ko settle kar sakein logon ki capabilities ko badha sakein intellectual capabilities ko badha sakein. Woh kaise ho sakta tha? Woh just woh just tabhi ho sakta tha jab aap unko ek data la ke de. Aap unko data ka access kara do. Aap unko unki information ka access kara do. What kind of information? Aap aankhon se kuch dekh rahe hain. Kya dekh rahe hain? Aap environment ko dekh rahe hain. That means aap usko capture karna chahenge. Aapko koi cheez aapko Taj Mahal dikhayi diya. Aap usko capture aap usko pirona chahenge. Aap usko rakhna chahenge apne paas kisi format mein. Toh aap unhone rakha ki kya log chahenge ki uski photo unke paas rahe. Right? Aapne koi content likha, aapne kisi ko chitthi likhi. Aap chahenge ki aapne kya likha tha, kya bheja tha, uska content aur ek copy uske aapke paas rahe. Yeh sab unhone vision la ke rakha. And yeh ek daur tha 1945. Now uske corresponding aap dekho. Jaise-jaise aapke interface jaise ki main pehle ki slide mein bata chuka hoon. Kaise-kaise aapke interface change hote chale gaye. Waise-waise aapka design of anything woh bhi change hota chala gaya. And inhone yeh rakh diya ki kuch bhi agar aap banaoge usmein humans ka involvement hona bahut zaroori hai. Bahut zaroori hai. Yeh kab realize hua? Apple Macintosh jab Steve Jobs ne products nikalne start kar diye. Apple ke woh daur tha 1980 ke aaspaas ka jo daur tha unhone jab Apple ka vision create karna start kiya us samay humans ki involvement ka kisi bhi product design mein kisi bhi app design mein rakhna inhone clarify kar diya aur achhe se dikha diya ki iska kitna successful outcome ho sakta hai. So aap yeh dekhiye HCI ek aisi ek area hai. HCI ek aisa domain hai jisse aap kisi bhi area mein chahe aap car designing mein jaaye, aap haptic design mein jaaye, aap tangible interface design mein jaaye, aap even keyboard design mein chale jaaye, aap display design mein chale jaayein. Right?

Camera design mein chale jaayein. Har jagah aapko humans ka involvement rakhna padega. Yeh ek clarification hua. Now, ab main baat karunga IoT ke upar. IoT kya hoti hai? IoT ka matlab agar hum full form dekhein jaisa yahan par likha hai likha bhi hai ki IoT is the Internet of Things. What is Internet of Things? Means there are some devices and they all are connected. This is the meaning of Internet of Things. And these things could be devices. Devices in the form for example computer, smartphone, your iPad, your earbuds, your smart watch, your smart glasses right, your smart car, your smart thermostat installed at home. It includes not only these things it also includes everything like for example people. You you want to get always updated. Aap chahte ho ki hamesha main update rahoon in logon ke baare mein. For jaise ki unki health ko lekar ke. Right? Woh kahan ja rahe hain? Kya kar rahe hain? Kis path pe chal rahe hain? Right? For example aapke koi unknown woh for example Dehradun se Delhi aa rahe hain. Woh abhi kahan pahunchte? You want to be get updated all the time. So Internet of Things is the network of physical objects. Physical objects could be anything like I am mentioned here. Jaisa ki maine yahan aapke saamne rakha. What now what they do? The moment yeh connect hote hain. Kis technology se connect honge? Woh ek alag ek aapka lecture hoga ki woh Bluetooth se connect hote hain. Woh Wi-Fi se connect hote hain. Woh Zigbee se connect hote hain. Right? Woh LAN se connect hote hain. And so on. Right? But woh karte kya hai? They they exchange the data. Woh data ko idhar se udhar transfer karte hain. Woh apna data master ko dete hain jisko chahiye ya master se data lete hain. So that woh apna kaam kar sake. Got it? Toh jaisa ki maine aapko example diya thermostat. Thermostat karta kya hai? Temperature ko adjust karta hai room ke as per the surroundings. Bahar ka data lekar ke andar ka data lekar ke us pe apna logic laga karke room ka temperature ko adjust karega. Woh smart thermostat hota hai. Advantage kya mila ki aapko ab usko control karne ki zaroorat nahi hai. Aapko baar-baar uske paas jaane ki zaroorat nahi hai. Aapko baar-baar usko touch karne ki zaroorat nahi hai. Yeh advantage hua. Right? Toh hence yeh aur yeh sab kya aapko batate hain? Yeh batate hain ultimate jo goal hai IoT ka is to connect the unconnected. This is the ultimate goal. Because kyun chahte ho? Aapko har cheez ki jaankari chahiye. Yeh human ki ek tendency hai. Yeh human ki ek you can say aap keh sakte ho requirement hai. Ab woh itna connect hona chahta hai ki use pata lag jaaye ki aaj mujhe kal agar Kedarnath jaana hai toh Kedarnath ka kal ka mausam kya hoga? Woh aaj ke mausam ki baat nahi kar raha. Woh ab kal ke mausam ki baat kar raha hai. Jo ki kal abhi aaya bhi nahi hai. Right? So goal of the IoT is to get woh saari information paana jo bhi user ko chahiye. User kaun hai? Aap. So like this figure demonstrates jo figure main aapko already pehle slides mein dikha chuka hoon ki kaise aapka ek area hai jo ki kitni devices se connect hota hai aur kitna data aap aap imagine kariye kitna data flow ho raha hai right, kitna data. Aur yeh per user data hai, per user data. Kitne user hain? I don't know right. Billions, trillions and so on. How kitna data flow ho raha hai, kitna data access ho raha hai, kitna data compute ho raha hai, kitna data processing mein jaa raha hai, you can't even imagine. Got it. So yeh kaise evolution ho raha hai HCI ka? Seed toh bo diya tha. Kab bo diya tha? Vannevar Bush ne kab? 1945 ke aaspaas. Right? IoT ka seed kab boya? Kab aaya yeh picture? Yeh 1990 ke aaspaas aaya. Abhi is samay jab HCI ka period chal raha tha 1945 se yahan par individual device ki baat ho rahi thi. Aap kuch bhi banao usmein humans ka

involvement hona chahiye. I yeh baat abhi tak nahi nikli thi. Kaise in sabko bhi connect kar sakte hain. Yeh kabhi nahi nikla. Yeh kabhi discuss bhi nahi hua. Yeh 1990 mein jaakar discuss hua ki kaise hum paanch chhah cheezein user ke according ya saari cheezein aur woh sab environments, situations, sequences, woh sab kaise jo ki unconnected hai jisko jiske baare mein user soch nahi paata usko kaise hum connect kar lein aur user ke paas pahuncha dein. Toh yeh 1990 mein iska seed boya. Phir hamari connectivity hamara connection hamari communication power hamari woh increase hui year by year, decades by decades. Now ab aap dekh hi rahe ho ki aaj hum 2000 uh 2025 year mein hum yahan par hain. Hum yahan aaj kitne data ke saath play kar rahe hain. Jisko ab hum dhyan bhi nahi dete. Woh aapke phone mein regularly aa rahe hain. Regularly aapke paas aa rahe hain. But aapko jo dekhna hai aap toh wohi dekhoge. But but at the end data ke saath aap play kar rahe ho. Aap information ke saath play kar rahe ho. Aap kaise data ko access kar rahe ho? Kitna kuch ho raha hai aapke paas? Benefits kya mile? Obviously automation. Yes. For example agar kisi ke ghar mein room temperature controlling system laga hua hai. Woh aaram se apna baith ke aap room temperature dekh pa raha hai ki mere ghar ka room temperature kya hai. Agar kisi ke ghar mein camera laga hua hai. Woh aaram se digital imagination camera in digital imagination access kar pa raha hai ki ghar mein kya chal raha hai. Maybe in the form of image or video or both. Aaj sab ho raha hai. Aap maintenance agar aap kisi industry ki baat karo log apne ek control panel room pe aap easily different-different plant P1, P2, P3, P4 saare plants ka data ek hi jagah aap dekh pa rahe ho ki is plant mein kya activity hai, is plant mein kya activity hai and so on. Toh now you compare ki aap pehle ke zamane mein kya hota tha ki aapko jaana padta tha. You have to send one person ki jao plant dekh ke aao. Lekin ab yeh area khatam ho gaya jahan par risk bhi zyada tha ki aap plant mein bhej rahe ho. Human ke upar risk hota tha. Ab aapko bhejne ki zaroorat nahi hai. Aapne risk factor zero kar diya. Ab aap easily information ko aap access access kar pa rahe ho. Aur control panel mein jo engineers hain, supervisors hain, technicians hain, woh easily data ko dekh pa rahe hain. Means aap creative maintenance bhi aap handle kar sakte ho. Cost reduction kitna ho gaya? Aap maine aapko already bataya ki aapne man power ko obviously just to aapko ek hire karna padta tha just to get and to have a ki aap continuous check kar sako saare plants ki. Aapne cost reduction kiya. Aapne jo other electronic system lage the to jo wahan par display karne hote the parameters plant ke woh ab woh zaroorat nahi hai. Woh that means un instruments ki bhi requirement hata hata di. Toh that means aapne cost reduction kar diya. Ek organization pe bahut bada burden hota hai yeh cost reduction. Now ab hum baat karenge. Maine aapko abhi HCI bataya. Maine phir aapko IoT bataya. Ab hum baat karenge inka role play kya hai. HCI mein aapko samajh mein aaya ki aapko kuch bhi agar banana hai humans ka involvement hona chahiye. IoT ka aapko samajh mein aaya bhai jo data aapko different-different jagah se laana hai woh yahan par aa laake aapko process karna aur saamne user ke saamne rakhna hai. Ab HCI yeh kaise bridge hai? How they are totally interrelated to each other. Toh basically let's understand through this example. Aapke paas P1 plant hai, P2 plant hai, P3 plant hai, P4 plant hai. Yeh do interface hain aapke same cheez ke liye. I1 aur yeh I2. P1 plant ka data jaa raha hai interface pe aa raha hai. Suppose yeh temperature data hi de rahe hain abhi for a time being. Yeh data de raha hai is format mein. Aap each time kya

data hai aap dekh pa rahe ho. Yeh data de raha hai digital format mein. Alright aur iske saath hi graph bhi de raha hai. Yahan par each time ka temperature data dikh raha hai aur uske saath hi yeh graph bhi dikh raha hai. Is kis cheez mein fayda hai? Kaun sa interface control panel area mein baithe logon ke liye bahut useful hoga? Yeh user hi batayenge. First of all. Doosra usi user ke basis par hi yeh panel design kiya jayega ki yeh wala ya yeh wala. Toh interface kyun chahiye? Kyunki at end maine aapko pehle hi bataya kitna risk involve hota hai. Agar aap itni si bhi information loose kar do. For example aapko zero to 24 hour ka data mil raha hai camera ka apne room ka, apne ghar ka. Aur aapko between 12 to one ka data nahi mila. Come right? Toh that means ab aap irritate frustrate ho jaoge ki where is the data of this this particular one hour. Kahan hai iska data? Aapko chahiye. Aapko access karna hai. Kya ho gaya itni der mein? Mere ghar mein kya hua? Kya kya activities perform hui? Aapko nahi pata chalega. That means aur agar aapko yeh data sahi tarique se nahi mila aapke phone pe, aapke laptop pe, aapke computing interface pe, woh bhi aapke liye bekaar hai. That means aap woh data sahi se dekh hi nahi pa rahe ho ya aap jo aapko 5 second ka time lagana tha data dekhne ke liye aap uske liye ek ghanta laga diya. That means woh human interface sahi nahi hai. Aapne woh interface bilkul bhi sahi se nahi banaya. Aapne humans ko involve karke interface nahi banaya despite ki aapki IoT device data bhej rahi hai aapko. Theek hai? So isliye toh yeh bahut important hai ki HCI aur IoT dono saath mein hi chalti hain hamesha. Jahan nahi chalti hai wahan obviously issues create hote hain. Jaisa ki maine bataya either in the form of time or in the form of some other hazards that could occur right? Which jisse human unaware the aur unko pata nahi tha ki is data ka yeh bhi matlab hota hai. Got it? Next isse in dono ke relation se in dono ke interconnection se accessibility increase ho jaati hai. Jaise maine aapko yahan create bataya ki aap aasani se data ko for abhi kya data hai? Isse pehle kya data tha? Aap aasani se dekh sakte ho. Right? Agar aap yahi nahi pata laga pao ki 1 ghante pehle kya tha ya mere 1 ghante ki activity ka data mein kya hua toh that means woh interface aapke liye achha nahi hai. Woh interface aapko real time aur maybe required time ki information aapko nahi de raha hai. Aur that means uski wajah se aapka time loss hoga. Aapki accessibility achhi nahi hai. Aap reach nahi kar pa rahe data pe. User frustrate hoga. Bahut saare parameters create ho jayenge. Right? Hence this is the advantage of linking both HCI with IoT is that HCI make the overall interaction, poor interaction user ka with the content intuitive and user friendly. This is the overall game. Next we have adaptive context aware interfaces we have. Aapke uh uh for example aapka uh again uh temperature wala agar hum aapka example le lein toh aapka interface accordingly woh adjust uski information change bhi honi chahiye. That means adaptive hona chahiye. As per the content whatever jo bhi IoT device aapka de rahi hain. For example location, time and usage patterns. Real time interactions bhi hona chahiye. Aisa nahi hai ki sirf aapka device sirf aap dekhne ke liye. Aap already aap you all you want ki aap yahan se baithe-baithe aapka jo camera hai jo ki installed hai aapki location pe aap usko reset kar sakein. Aap usko restart kar sakein. Woh sab interconnections bhi create hone chahiye. Yeh sab requirements jo aati hai, yeh users hi batata hai. Yeh aap front nahi nikaal sakte. At the end IoT automate karta hai repetitive task ko. Because and HCI ensure karta hai user ke control mein jab jab bhi zaroorat hoti hai. Now HCI techniques in IoT. Ab hum thoda is

pe agar baat karenge toh technique aapka jo process hai koi bhi IoT based interface banane ka woh user centered design hona chahiye. User centered design matlab maine aapko already bataya lekin ab thoda aur detail mein baat karenge. It is a process where it prioritizes the needs preference what humans like, what humans don't like, what they feel irritated where they feel frustrated in what situation they don't want to be did want to be in connect. Woh aana nahi chahte connections mein digital device ke saath. Woh saari baaton ko sun kar ke aapka process woh interface aap jo bhi hai aapka IoT wala aap woh create karenge. Right? Yeh fully iterative process hota hai. Aap ek interface banate ho. Ek device banate ho. Kisi ek idea ke upar. Kisi ek problem statement ke upar. Aap usko banate ho. Right? Phir aap usko further refine karte ho. Then further aap usko problem user ke feedback lete ho. Then phir se aap usko banate ho. Toh yeh poora iterative ek hi process hota hai. Now significance of iski significance kya hai? Basically UCD ki, it ensures accessibility, usability and satisfaction. Maine aapko already bataya pehle kis tarike se aap UCD ensure kar sakta hai, karta hai aur reduce karta hai learning curve. This is very important. Yeh toh karta hi hai accessibility. Yeh toh karna hi karna hai. Right? Learning curve. Aapne koi app download ki. Ab aap us app ko use karne ke liye aapne 10 minute laga diye. Sometimes it happens. Sometimes you you can you can imagine. Yeh sabhi ke saath hota hai ki aap koi phone khareedte hain. Maybe aapne koi naya phone khareeda. Aapko koi feature us pe dhoondna hai ki yeh feature kahan hai? Aap dhoond hi nahi paate ho. You go and ask the vendor. Aap unse poochho sir yeh yeh ek particular task is camera app mein kahan hai? That means woh camera app us particular situation ke liye usne dhyan nahi diya ki kaise users. Ab since camera us phone ki user toh koi bhi ho sakta hai. Even a 10th class student or a 70 year old old man, koi bhi ho sakta hai. So that means woh interface us sabki presence ko dekh ke, sabki availability ko dekh ke, sab type ke audiences ko dekh ke design nahi kiya gaya hai. That means learning curve yahan par bahut zyada hai. Yeh ek bahut important cheez hai jo ki bahut kam log is pe dhyan dete hain. Finally what are the core principles of UCD for IoT? Aapko yeh sab karne ke liye the most important thing is that you should be empathized. Empathize ka matlab hota hai ki aap as a designer, as a developer aap apne aapko user ke gloves mein, shoes mein, unke paas apne aap ko rakh do. Aap unko observe karte raho ki woh kya kar rahe hain, kya nahi kar rahe. Around your a problem statement or the or the kind of problem which you are aap dhoondna chah rahe ho ki mujhe is area pe kaam karna hai ya is tarike ki problem ko mere ko door karna hai. Toh aap kaise karoge? Toh yeh ek sabse pehla step hai. You aap empathize karo. Aap user ke saath baitho. Aap user se baatein karo. Unko observe karo. There are multiple steps. Some on step main aapke saamne naam rakh deta hoon. But abhi main uski details mein jaa nahi sakta. Because woh bahut hi uh it is beyond the scope of this particular lecture. Right? So the first technique is participant's observation. The next technique is interviewing. And there are many more as well. Har ek technique aapko ek naye tarike ki information deti hai. Woh naye tarike ki information helps you to define the problem statement first of all and then accordingly ideate the problem statement and then accordingly prototype the prototype. And this whole process we call it as a design thinking process. And you will see these things in my case study as well. So like here I have mentioned first you conduct user interview survey field studies to

understand needs. Needs of what human and all stakeholders. Humans sometimes it is a very ambiguous terms. Let me clarify that ambiguous symptoms that it's like for example this particular interface will be useful for this kind of population not for whole. So that means your stakeholders are these peoples only not all other peoples. So humans belongs to this category. Stakeholders belongs to this category. That means to understand the needs of stakeholders. That's why I have explicitly mentioned stakeholders here. Next then as mentioned before you go and define the problem statement. Then you ideate and then you prototype. Finally you go and test whatever you have designed and then you further re-iterate for example a wearable fitness tracker, study user fitness goals, unke habits, what they want to aware of right. Then aap uske GUI options ko create karoge. Aap uski metrics ko wahan produce karoge which will include heart rate, calories, BP, pulse rate and so on. Right? Feedback aap continuous lete rahoge. Aapne ek interface banaya jo ki aapki smart watch pe run ho raha hai. Aapne us pe yeh saari cheez woh display kar raha hai. But at the end you will keep on getting feedback by displaying a one notification, one one one you can say dialogue box where you will ask. Jahan par aap unse poochoge ki anything you want to get change in this interface. Means this continuous iteratively you are taking your feedback from from from users. Aap users se baar-baar le rahe ho. That means aap is interface ko kyunki yeh already internet se connected hai. Yeh interface Wi-Fi se connected hai. Aap iske interface ke layout ko aap phir se aap design aap produce kar sakte ho. But yeh same cheez yahan par laagu nahi hogi. For example agar aapne physical interface banaya. Aap physical interface yeh already 1 crore people ko distribute ho rakha hai. Aap kaise isko dobara create kar doge? That means aapko zyada effort daalna padega. Physical category kind of kind of interface ko market mein laane se pehle dena padega in comparison to software kind of interface. Software kind of interface they mostly follow with the agile approach. Right? Agile approach ka purpose hota hai ki jahan par aap multiple iteration activity perform kar sakte ho aur yeh type ke jo physical interface hote hain aap yeh follow hote hain mostly waterfall approach. The moment they come to the market within before coming to the market you can take or make use of this within uh do you you pass the development of physical interface through variety of journey. But this is a little bit more explanation aapke saamne main rakh raha hoon. So this is what a particular differences between traditional design and user centered design. Traditional design pehle yahi hota tha ki pehle sirf focus karo technology pe. Kya technology available hai. Right? Like for example mere ko aaj yahan se udhar data transfer karna hai ek Bluetooth se. Toh main kya karunga? Maine mujhe yaad hai bhai Bluetooth ek technology available hai. Main usko leverage karunga. Main usko use karunga aur main woh ek button click karunga jo file ko mujhe transfer karni hai and then main wahan par transfer kar dunga. Lekin user centered design kya hoga? Woh focus karega ki woh ya usko is tarike se transfer karna hai ya there should be other mechanism. Usko kisi aur tarike se transfer karna hai. Woh woh technology ko baad mein leverage karega. Pehle woh user ki needs ko pehle samjhega ki usko kis tarike se transfer karna hai. Rather than aap usko impose kar do kisi user ke upar ya aapko isi tarike se transfer karna hai. So that is a old way mein static design hota hai. Right? Yahan par iterative feedback driven hota hai. One size because aapne ek hi tarika rakha isliye one size fit

karega. Yahan par woh adaptive ho sakta hai. Because aap maybe one year baad aapne dobara question pooch liya ki yaar do you want to again transfer in the same manner. Usne bol diya no. Obviously you have to fit. You have to. So that means your interface should be adapted. Modalities uh toh interaction modalities hoti kya hai? Pehle woh samjho ki kaise user IoT system ke saath for example again I am taking example of smart thermostat. Yahan par aapki temperature readings adjustment hai. Right? Yahan par ek dial hai jisko aapko rotate karna hai. Jo usko aap rotate kar sakte ho aise karke. And then you move it. Right? Kaise woh user IoT system ke saath interact kar raha hai, app ke through kar raha hai, dial ke through kar raha hai ya dono ke through aapne feature de rakha hai. Whatever that is a interaction modalities. Right? And it heavily focus on the user input. What kind of input we have apply aur doosra isse kya output aane wala hai? Because agar aap interaction tabhi complete hota hai jab aapka bi-directional flow hota hai. Bi-directional flow ka matlab hota hai ki input gaya, output aaya. Agar aapka input gaya, output kuch nahi aaya, woh interaction nahi hai. This is a simple definition of interaction. Interaction is always a bi-directional. Right? Common interaction modality aap jisko aap bahut aasani se paa sakte ho. Let me show all first. So touch interfaces by mobile phone aapka. Right? Voice interface again your mobile phone, your your laptops. Gesture aapke mobile phone mein hote hain. Gestures. Wearable interface. Smart watch, smart spec. We are a wearable right. Smart pacemaker right. Smart sugar monitoring wearable device. Now jitne maine advantages bataye woh saare advantages woh toh hai hi. Lekin kuch complexities ke regarding bhi humein taiyar rehna chahiye. Humein pata hona chahiye. Let me put it all first. Design complexity maine aapko pehle bataya. Aap koi bhi product bana rahe ho. Maybe aapne ek general users ko le liya. Lekin woh jo bhi aapka product hai woh in users ke liye hai specific for example older adults aapne utha liye. Aapne product ki testing kar li ek normal adult ke saath. Aapne product ki testing kar li. Lekin woh actual user yeh hai. That means demographic ka issue hai wahan par. Aapne dhyan hi nahi diya ki aapka participant kaun hai actual mein. Lekin aapne kya kar liya? Despite your device is IoT device. That means IoT device aapka sahi se role play nahi karega jab woh market mein use aayega by these people. Hai. Doosra aap sometimes aap interaction change kar dete ho bina bataye ki aap button se nahi ab slide se change karna hai aapko control. That means again despite again woh IoT device hai. For example previous agar main example loon smart thermostat. Aapne har thermostat mein woh dial button aa raha tha. Lekin ab aapne dial ki jagah kar diya slider button kar diya. Maybe slider bahut easy ho chalo koi nahi. Aapne koi aur button kar diya ki aapne do push button de diye. I don't know. What is the meaning of two push button? Jab kya bolte hain? Dial button se kaam chal raha tha. Woh easy to move tha, easy to adjust tha. Kyun? Aapne do push button kyun diye? That means aapko user ko batana padega kisi tarike se. Toh yeh consistency sometimes woh maintain nahi reh paati hai. Yeh bahut bada issue ho jaata hai. Usability again too many options, too many data. How to interact? How to how to adjust the readings? How to adjust how to play with the data? Kaise unke saath play karein? Sometimes possible nahi ho paata. Right? Yeh issues create ho jaate hain. Privacy security because data ke saath aap play kar rahe ho. Overall IoT mein kya hota hai? Data hi ho raha hai. Idhar se udhar idhar se udhar data hi jaa raha hai.

Toh aapka data kis cheez ka data hai? User ka data hai. That means privacy part aa gaya. Ghar ka data hai. Again privacy part aa gaya. Right? Aap kisi ke data ko door se access kar rahe hain. Again privacy part aa gaya. So yeh bahut important cheez hai. Privacy. So at each and every stage it's your responsibility, it's your task, it's your requirement or as a part of your requirement list that you have to take care jisko aapko dhyan mein rakhna hai ki privacy kabhi bhi privacy and security kabhi bhi break na ho. Hamesha user ko pata rahe ki aapke saath kya kiya jaa raha hai ya aapke data ke upar kya kiya jaane wala hai. Resource constraints aate hain. Sometimes aap jaisa imagine karte ho woh nahi banana possible hota hai. Nahi ho paata. Right? Scalability sometimes aap soch rahe ho ki is interfaces mein main teen parameter abhi main dikha raha hoon. Main kya main koshish karoon ki yahan pe teen aur dikha doon. But woh possible hi nahi hai kyunki itna iska hi data itna zyada display ho raha hai. Agar jaise hi agar aapne isko add kar diya that means aap cognitive load badha doge. Aap user ko bologe ki iska matlab aap user ko force kar rahe ho ki aap is particular cheez pe dhyan dene ke alawa aap is pe bhi dhyan do. That means aap unko country note bana rahe ho. Aap unke upar burden daal rahe ho. Aap keh rahe ho ki aap itni saari information ek saath process karo. Aapko yeh hamesha yaad rakhna chahiye hamari body ke andar hamare brain ke andar teen type ki memories hoti hain. Ek hoti hai sensory memory, ek hoti hai workload memory, ek hoti hai backend memory. Right? Workload memory mein jaakar ke aapka saari processing hoti hai. Sensory memory mein kya hota hai? Aapka data jo aap lete ho woh easily sense hone ki koshish karta hai. Agar woh sense nahi hota toh again woh sense hota hai ya nahi hota. Whatever woh in both case mein workload memory mein jaata hai aur woh peeche ki jo stored memory hoti hai wahan se kuch information deta hai then woh finally interpret karta hai ki information karna kya hai. Lekin agar aap socho ab yahan par ek information aa rahi hai. Ek information ko access kar paana us pe kaam kar paana aur peeche ke information se uska support le paana woh aasan hai. Agar aap yahan par 10 information daal do sensory that means aapne load badha diya. Aapne load badha diya. Load kahan badha diya ki aapne 10 information aapne sense ki. Woh workload memory mein gayi. Us 10 mein se paanch ka information ke baare mein aapko kuch pata hi nahi tha. Means ab aap use focus kar rahe ho. Aap keh rahe ho ki user aap woh apne backend ki memory ko soch access kare. Access jo bhi koi information aa rahi hai nahi aa rahi. Ab aap yahan stuck ho gaye. It's like a stuck area. That means ab aap yahan pe ek ghanta laga rahe ho samjhne mein. That means jo information aap pichle ek second mein access kar lete the. Ab aapne ek ghanta laga di hai. Ab aap chhah-chhah information ek saath access karne mein lage pade ho. Aap usko samajhne mein lage pade ho. So this is called a cognitive load. This is how the cognitive load work. So it's a very uh you can say trade off. There is a trade off exist. Right? As a whenever we go as a designer whenever jab bhi hum ek as a designer ke roop mein kaam karte hain. Hum koshish karte hain ki hum bahut zyada se zyada zyada se zyada yeh bhi information yeh bhi information hum de dein. So that hamare interface ki price value badh jaaye. Lekin woh yeh yaad nahi rakhte ki itni saari information dene se woh yeh evaluate hi nahi karte cognitive load kaisa hai. Aap obviously baat ko load kaise evaluate karenge woh ek alag scenario hai. Woh ek alag kahani hai ki aap kaun si study karoge but woh yeh evaluate hi nahi karte. Usse kya hota hai is interface ki value price badhne se pehle

kam hone lag jaati hai. Aur yeh trade off maine isliye bola yahan par ki designer wants to put multiple things. Pehli cheez. But they don't play with but memory ki ek apni ek requirements hai. Ek interface kaafi saara cheez dena chahta hai. But memory zyada access nahi kar sakti. Zyada ek saath process nahi kar sakti. Right? So there is a trade off. Now aapko in dono ko balance karna hai. This balancing ka jo tarika hai na it takes heavy effort of heavy effort. Bahut samay leta hai. Bahut samay leta hai. Har ek cheez ki study hoti hai. Har ek cheez har ek icon ki study hoti hai. Aake yahan pe save option kya save save option aise likhna hai ya save option ka string symbol dena hai. Right? Har ek point ki study hoti hai. So yeh bahut important cheez hai. Uh so this is about a scalability and and that I mentioned. Then finally there is a culture. Ethical concerns also comes. Ethical concern maybe aap kisi ek country. Ab now countries ki baat karte hain. Like for example UK India. Yahan ke log ek alag tarike se information access karte hain. Yahan ke log alag tarike se information access karte hain. Toh aapko us concerns ko bhi dhyan mein rakhna hai. Cultural kaise log inki textual language kaisi hogi? Kis tarike se logon ko zyada reachable log reachable reach ho paayenge apni information ke prati. So this is one of the example of health monitoring. How the now you see this is a smart health monitoring systems. This is one of the sensing device. This is one of the sensing. Now you see how much data is getting transmitted through the base station to the cloud and then to your interface whatever you are. So here is highly involvement is the HCI area this part right. And here it is the IoT area because here you are getting lot of data. Aap bahut saara data bahut saare device le rahe ho user ke baare mein uski heart ke baare mein uski full body ke baare mein right, doctor ka data right, other data and then you are transmitting and then you are displaying it here. Agar aap socho yeh padh hi na paaye ya is data ko padhne ke liye doctor apna agar ek ghanta laga raha hai that means aapka interface achha nahi hai. Aap doctor ko enable kar hi nahi rahe ho ki woh instead of one ki woh 10 logon ko 1 ghante mein dekh le. So yeh ek bahut bada issue hai. Yeh ek bahut badi problem hai jisko hum HCI ke roop mein HCI ko use karke solve kar sakte hain. Applications obviously smart thermostat aap kaise data display kar rahe ho? How you have connected TV data diffuser dining room whatever. Education. Smart digital board. Lecture recording system. How a person is standing over the podium right. Interactive display and so on right. Emerging trends jo aajkal nikal ke aa rahe hain. Voice driven out. You must be aapne dhyan dhyan diya hi hoga ki Alexa based interface kitne saare hain. Right? Agar Alexa based interface market mein hai, hum baat hi na kar paaye Alexa se. So that is again a issue of HCI. Right? Remote. Remote ek aisi cheez hai ki jismein itne saare button hote hain, lekin aapko button ka purpose hi nahi pata hota ki is button ka purpose kya hai. Kya meaning hai yahan par red aur blue ka? Kya meaning hai yahan par in buttons ka jo idhar likha hai? Kya meaning hai in points ka? Kya meaning hai inka? Kya meaning hai jo yahan par kabhi aapne buttons dekhe honge right. Menus mein jaakar ke humein kya-kya cheezein mil sakti hain? Remote ek bahut bada ek barrier raha hai users ke liye in terms of their usability despite woh transfer kar rahe hain data aapke haath se TV ki taraf se. Now ab hum Virtual Reality, Augmented Reality duniya ki taraf hum jaa rahe hain. Hum badh rahe hain. Toh obviously aapko naye experiences chahiye. Aap aap kisi learning point of view se agar dekhna chah rahe hain that means aapko immersive

experience bahut zyada chahiye. Aapko immersive plus realistic chahiye. Agar aap koi video dekh rahe hain obviously aapko immersive chahiye. Toh aapko balance bana ke rakhna hai. Ab aap again yahan par woh cheez laagu hoti hai ki aap kitna cognitive burden daal rahe ho. Aisa nahi ki aapne har cheez virtual mein dikha di. Ek hi scene mein aap dikhayee jaa rahe ho. Dikhayee jaa rahe ho. Dikhayee jaa rahe ho. Again uska evaluation hona bahut zaroori hai. AR glasses aap chashma pehnte ho. Aap usko dekhte ho. Aap itne saare visual content dekh sakte ho. Aap aise-aise ghuma ke apne content ko access kar sakte ho. Variety of content jo aapke saamne display hote hain unko play kar sakte ho. But again a problem. The problem what is the problem? Kya problem hai yahan par? Again ki aap usko touch karna hai, feel karna hai, kaise manipulate karna hai? Kya rotary mein ghumaana hai ya usmein khelna hai. Kis tarike ke gestures karne hain? Woh saare issues aapke wahan par aate hain aur kaise aap usko handle karoge immersive experience ko enable karne ke liye for the user. Maine is pe pehle baat ki ki data pe already baat ho raha hai. Toh privacy and data security bahut bada challenge hai. Bias and fairness. Alexa aap use kar rahe ho Africa mein. Alexa aap use kar rahe ho India mein ya US mein. Ek Alexa ki jo tone hai woh ek bahut bada role play karegi uske usability mein. Uske uski market value mein ki Africa mein kya woh bik raha hai? Kya India mein woh bik raha hai? So usko pehchanne ke liye usko janne ke liye aapko yeh ek bahut bada issue hai ki aapko biasness jo yeh hai aapko yeh hatani hogi. Aapko iski voice ki interface ki jo interaction hai with the user aapko uske saath play karna padega. Yeh ek bahut bada issue hai jo rehta hai algorithm ke wajah se. Aap voice kaise change kar doge algorithm ki jis tarike ka aapne speaker rakha hai woh usko woh aise hi aawaz dega. Lekin aap aap bolo ki woh as African aapko bolna start kara de ya as a Nigerian way mein bolna start kar de. Woh bahut hi bada ek woh hai unki tone mein. Speaking in Hindi is a different way in comparison to speaking in Hindi in actual Bhojpuri way. Right? So ek yeh biasness. Some yeh saari cheezein hain jo effect karti hain kisi ki product ki market value pe. Hum jab hum global level pe baat karte hain. Environmental impact obviously e-waste generation hoga aapka. Bahut saari cheezein bahut saari electronics use hongii. Energy consumption zyada hoga right. Financial concerns aapke bahut zyada create ho sakte hain. Ethical use mein and I hope aapko samajh mein thoda sa aaya hoga. Aapko thoda sa insights aapko mile honge ki what is HCI? IoT kya hai? IoT aur HCI ka interplay kyun zaroori hai? HCI kya cheez deal kar sakta hai? IoT kya cheez pe deal karta hai? Aur in dono ko ek saath mein rakhkar device ko banana kitna zaroori hai? Kitna important logon ki problems ko yeh solve kar sakte hain. Yeh saari cheezon pe humne aaj discuss kiya. Maine woh bhi create bataya. Kitne challenges bhi ho sakte hain. Privacy ko lekar ke, cultural issues ko lekar ke, societal issues ko lekar ke, voice based interaction ko lekar, biasness ho sakte hain. Isko kaise resolve kar sakte ho, kitna resolve kar sakte ho? Yeh sab aap pe yeh jitne bhi challenges point of view hote hain, yeh statistical point hai. Aapko study karni padegi. Yeh kisi ki ek theoretical way mein aap usko nahi keh sakte ki mera by mera device 22 ke saath aayega. Mera device handle kar lega. Aisa aap nahi keh sakte. Aapko us pe study karni hogi. Study means users study corresponds to user. Whenever aap baat karte ho product ko market mein laane ki ya interface study means users. So with this I hope aapko thoda is pe yeh lecture samajh mein aaya hoga. Aapko samajh mein aaya hoga kahan

se kya evolve ho raha hai. Logon ne kab beej boya tha communication ka. Logon ne kab beej boya tha IoT ka? Kyun zaroorat padi? HCI kahan role play kar raha hai? Aapne aapne yeh saari cheezein aapko yahan is lecture mein samajh mein aayi hongii. With this main aapko bahut-bahut dhanyavaad karta hoon ki aap is lecture ka part bane. Some things I maine kayi baar repetition kiya hoga. Woh isiliye kiya hoga because it takes I want to be focus. Main focus karna chahta hoon ki woh cheez aapke dimaag mein hamesha rahe. Woh rahe hamesha aapke dimaag mein jab bhi aap usko jab bhi aap is technologies ko aap apne paas suno ya rakho aap work karo in area mein. Thank you so much. [Sangeet]