Lecture on Pervasive Computing and Smart Devices

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Speaker 1 00:00

Like implement a very simple mobile app or like I want to use sensors to test the compression. What is. You have to, you have like to ask you a simple question. What is the aim of that task? You like, you will like spend enough time going for the implementation and do like the writing and do the research. What is the advantages of that work? You have to think to yourself this, this is that question. All right, so your work should. Has a. All right. That's why like we like the, the final project to be similar. Like a paper that would be suitable of the submitted training conference. For example, like, if you have good findings, if you have good findings, you can like at the end of this course, like do like some touches on that report and then you can submit it to account. You can discuss with your supervisor if you don't transfer as an asset. Like we can work together.

Speaker 1 01:06

All right, so this is like the, the content of the report. So now the question is what we shall do in that report in that project. So here's like a list of projects. If you don't, again, like, if you don't like this list, you are, you are free to bring your id. Okay. Like I have this idea. I want to implement all. But the idea should be like in the same level of these topics, right? For example, again like, maybe like those are crazy ideas. It doesn't, it doesn't like important that you are familiar with all like these ideas. You need like some research. You are masters. You need like do some research. Like what? For example, like indoor localization of devices in classroom and bar. For example, we're sitting in a room and I want to like know how many devices are connected to like this. If we have like a local network, suppose that this classroom has a local network.

Speaker 1 02:23

And then by using that application, I want to like see how many devices are right there. This is an id. What do you think why we need that id? Like why we need that? This is the benefits of that. Like we can share your thoughts about this item. Why we need like to have a list of all of like devices connected to our network. Why we need that? Any thoughts? Suppose that I'm like a network administrator, like system administrator. I want to like control the behaviors of the devices to my name, saying that I can send notification to those devices somehow. Welcome to my classroom. Good morning people. I can send notifications to those devices by using a very simple protocol. All right, Overlay. Even like whatever the type of connections, maybe like we have wireless, maybe like we have Bluetooth, whatever. Any type of connections is valid. So we have like lots of activities we can do by this project.

Speaker 1 03:49

I can specifications, I can like ask questions. I can, I can like do some statistics, gather information about those devices. What is like how long each device has waited to that minute, what the activities they're doing in, in that period of time. All right, how many packets going that time to each device. So lots of information we can, we can learn or like we can gather from that idea. So this is like one idea. The second idea, which is edge computing decision algorithm. So what is edge computing? We discussed that in the first lecture. Edge computing is, suppose that we have like sensors in one location. So those sensors are like dummy sensors. They don't have any computational devices or like any computational algorithm. So what they do is they sense the data and send it somewhere else. Temperature sensors, humidity, whatever, light sensors, movement sensor, whatever.

Speaker 1 05:07

So just they sense the surrounding environment and then send the data over the network to a server. So that server will do the computing and then like do the analysis and do the cleaning and so on. So edge computing is instead of like sending all of like the data to a server? No, we can like install a small computer device or small server this close to those sensors. Right. For example, like we have a Raspberry PI device that's connecting to all of these sensors in this building, for example. And then that Raspberry PI will like collect all of the data and do the computational, the algorithm, clean the data, remove the invalid readings, do some like algorithms to do like to extract the data and give us like useful information and so on. So we call that edge compute. So we can like design something like this edge computing position algorithm. Instead of like we like, we use the push the processing to add edge device.

Speaker 1 06:20

So we can like take the data from or like these sensors to any edge device. So why we use edge devices? Any idea why we use edge devices? Latency. Sorry, latency. Latency is the reason. Like I don't want to like make traffic over the networks. For example, like if we have like a sensor that sends the temperature for this room. So why I have to send all of the data to the main server, just sending dummy data over there. What I can do is I can like install an edge server, an edge computer or edge computing entity beside this room. It will like handle all like the data to locally and then send the useful information to the server. So in this case the network channel or bandwidth, it won't be all right. So we can do the business here and then, and then like we can send it from useful information to the server later. So that's why like we use Inch compute. So that's one project.

Speaker 1 07:37

All right, so that's why like this project is related to quality of service qas. So we have to do quality of service. So this is like part of that project, another project which is estimate vehicular congestion. Congestion in the network exists everywhere like at any time. So for example if we have a service and then we have like lots of lots of access to that service, it means that it will cause congestions for that for the network or for the server that like for providing that service. So we can like design a, design a software that will like sense or like check the traffic coming to a specific server, a specific service and then we can like say that oh we have high traffic, we can like divert the traffic to another routing network or whatever. All right, so this is like another option, another idea would be context aware services. So contact context aware services is like an idea where for example I'm like moving in a new building so I don't know what are like the services installing that building.

Speaker 1 09:17

If we have sensors, if we have like light sensors, movement sensors, temperatures, we don't know like we're not aware of that. So context aware services is like a project that in form like give us like a wondering presentation about like we promote the services, we have that service that this building has the following services that ready to be used. So you promote the services you have to other devices. Mobility prediction so this is like another idea where like prediction mobility and use of the facilitate network connectivity. For example like if you move from like network to another network. So we call that mobility connection. So you can like switch the network. For example like when you reach home you will be like in a different network. So your phone will be like rely on the service provider network while like you, you enter your home like automatically the mobile connect to the WI fi for example that mobility network prediction.

Speaker 1 10:34

So you can like say that you're like coming from this network going to another network and so on intent based networking here like we could have used that. It's an idea where we can like use it in mobile wireless network where we can like have an application that give us the cloud of networks we have surrounding and like provide us with the best bandwidth that we collect so and so on. So I'll leave the list for you guys to look at it again. Like don't, don't like look at each of these ideas and like it's hard to be implemented. Like no, you need like you need, you need like to discover new areas. It's not, it's not important that the idea, you know, you have to do some research. For example, like I'm interested in that topic, but the details, I don't know the details. I like that idea but I'm like, I'm worried about the details. So what you have to do is do some research.

Speaker 1 11:52

We have lots of for example like papers published papers that talking about each of one of these topics. You can like. Yes.

Speaker 2 12:48

When is the deadline for submission? When is the deadline for submission of this. What kind of things? He's expecting. He's expecting paper. What is he expecting?

Speaker 3 13:13

Here and here. Now he's explaining things. We go to. We go to our house. There's a guy PDF. Yeah, here. Right.

Speaker 1 13:25

Explaining things like this is better. Now back to the topic. So as I mentioned, it's not important that you be like aware of like all of the topics, all of the details. What you have to do is for example, like you can discuss an idea with your group members and say that okay, let's do that, let's do that, let's implement that idea. And like you have to do some research how we can do it, what is the objectives, what is the benefits of doing that and so on. In this case you have a brainstorming with your group and then like you can start with the implementation. Any, any question? Regards about the final project. Any questions? So we'll start because like we have a tight time today. Like I will start posting the deadlines for all of like these milestones. For example, like the proposal. The proposal. The proposal will be like the due date for the proposal this week.

Speaker 1 14:46

All right, so let's say Friday. Is that okay with you guys? Because I like, I will use the weekend to look at your submissions and then we can like approve. So you can like start working on the final project from like the next week. All right, so we will do all of like these fun stones today. All right. And then we have. And then for the project demonstration, as I mentioned, like we'll sit the last week. It depends on how many, how many groups we have. So I will dedicate fifteen minutes for each group for the presentation. So we can like use one or two lectures to do the presentation. All right, So I give you exactly the date at the time for each group for the final presentation. Okay. Any questions? You are, you are free to use any AI tool. All right. As I mentioned in the first lecture, I have no problem with that. But you have like to tell me which tool did you use and in, in which context and in which way use.

Speaker 1 15:57

Did you use like the AI tool to do everything for you or like what's the percentage of like the usage of those? All right, so this is very important. That happened to me like last, in the fall, like last fall I was like giving a lecture which is web development. I mean web development. I teach my students how to use HTML, HTML tags, css, like commands. Very basic, very basic commands. And then I asked them like to do an assignment. The assignment was different, simple. Then I have noticed that one of the students submitting very nice presentation for their assignment. Okay, So I look at the assignment and I check the code. The code is like written in very high context. Programming language, that language even like I didn't introduce it to my students. That's okay, no problem. Like we have a free of education. Like, like you can say that I don't like the way of your teaching.

Speaker 1 17:18

So I will use my way of like doing the things. Perfect, that's great. Then I asked the students like, can you tell me like how you did that? Then they start like scratching their face. Like here, like we did this. Okay, can you teach like, tell me like, because I'm not aware of what you're. Can you give me like some tips how to do it? Can you change that part like it is look like doing this. Can you do this? I don't want like, I don't like that part. Can you change it then like this? Oh no, you know, I, I'm not ready now for like to do that then when I have it. So if you want to do something, that's fine, but you have to be aware of what, right? This is the issue with our new generation AI tools everywhere. That's great. I use them every day. But you have to know what you are doing. And if like suddenly they said that we don't have AI tools like, which is, I'm like, it's not like the packed.

Speaker 1 18:34

But again like you have to know what you are doing there. All right, any questions guys for the final project? Okay, we're good. So let's start our lecture. Okay, so in today's lecture, we'll talk about smart devices. In the previous lecture, we talked about the difference between like pervasive computing and like other. For example, like computing and smart devices. So today we'll talk about what we mean by smart devices. Devices. All right, so in today's topic we'll discover or we'll discuss what we mean by distributed system viewpoint and what is sensing elements and smart dei Model. So let's talk about sensing IOT sensors like sensing environment once. Once we are talking about pervasive computing. It means that we have like suppose that we have wearable devices, wearable sensors. And then we have to know the limitations, the advantages of those sensors.

Speaker 1 20:10

All right. In the previous lecture we discussed for example like why those sensors, the wearable sensors are very tricky because of power consumption. All right, that's like one of the reasons like people like still that area needs to do more research. They drain power quickly. Suppose that we have like pacemaking or maker and then we need like to charge it every day. So that doesn't make any sense. We have like to develop systems that rely on sensors that have let consumers less power. All right, so to do this we have to understand what are those sensors, how they like connect together, what is the design of those sensors. So that's why like here sensors could be simple or smart. So we have simple sensors or smart sensors. Simple. Those generate just data. All right. For example like we have temperature sensors, sensors just it will like sense the temperature around and like send the reading.

Speaker 1 21:23

Smart sensors that support filtering. Like okay, sometimes like we have false data. How a sensor can generate false data? Any idea how a sensor can generate false data? So for example, suppose that we have a sensor that sense temperature in this room. All right, so the temperature in Celsius is like twenty, twenty five, twenty six. Suddenly we have a reading of like ninety, eighty or whatever. Sometimes like sensors like do that they send false date. What is the reason? Could be like any like type of reasons. All right. Could be like having with something with the circuit, something with the power. So they will discuss about that. So we have like false data. So the sensor doesn't, doesn't like, doesn't. Doesn't care about the false data. Just they send it to the server, whatever that data is. Those are the basic or simple sensors. But smart sensors like they will like have like some capabilities.

Speaker 1 22:32

For example, like filtering for example. Like if the data is between like specific threshold, I will keep it else I would throw it away. Right? So this is what we mean by filtering capabilities. Or like they have like some programming capabilities. I can program that sensor like okay, this sensor can be can working in the early morning or specific time. I need like to collect data for at this time only at this location, at this high, at this like whatever. So we can like write some code for those systems to make them run. So usually like systems can be like having they receive like or like sense the elements. They collect collect data and Then we have like microcontroller to process the data. Did you guys deal with microcontrollers or Raspberry PI before? How many of you guys, like program a controller? Okay, so you know, like how to program controllers, microcontrollers and Raspberry PI.

Speaker 1 23:49

So maybe like in the next lecture we'll give you some components to look at it. Those are like kind of controllers that Raspberry you should be familiar with. All right, so we have like sensors connect to microcontrollers somehow using like a network, wi fi, network, whatever. So they connect to microcontrollers and the microcontrollers will like take the data, process the data and then transmit it to somewhere else, transmitted to the users, transmitted to servers and so on. So that's why like many sensors communicate through some standard interfaces. For example, like all of like these instruments, they have like digital input and output. So they have like collect the data through those interfaces. And most of them communicate via the ip, the address. So I'm talking about the microcontroller there. All right, Most of them, most of the sensors like connect to microcontrollers and they can like communicate with the microcontrollers through like the standard communication network.

Speaker 1 25:06

For example, like they can communicate over IP address, WI Fi, Bluetooth and so on. So there are emails to communicate. So if you don't know or deal with microcontrollers, microcontroller is something like this. So this is like a Raspberry PI. A Raspberry PI is a digital computer by itself. So you can like use it as a computer. This car, it's like the same size of a credit card car, right? So it's like something like this. It has a processor, it has memory, it has input and output. It has everything. All right, so for example, two days ago I was visiting a store and then the, the I have like, you know, like the price of chip machine, the price chip. So they're like the can scan the barcode and then they can like display the price of that product. So the box was open. It's not like a covering box. It was open. And then I look at the box and it was the item, very simple.

Speaker 1 26:20

So what is inside the box is a Raspberry PI like this. All right, and then a camera, like a normal camera, like laptop camera, which is connected, an external camera which you can connect it here. It's connected through one of like these ports. So this is like the ports of the camera. All right. And it has module, it has DDI okay, it's connected here to, to do the scan. Alright, so and what else to display the price they use LCD display and it's connecting to another dvi. All right, so that's it. So the camera captured the barcode and then they have a small program. The program is like same in the memory of this Raspberry PI. So they were like they have a small database to read the barcode, dig in the database and then display the price. Very simple. All right, so this is like one of the benefits of using those controllers and Raspberry one. So input and output.

Speaker 1 27:43

So any, any controller has input at outputs those pins. So the pins here, they have like input and output pins. So pins we can program program. Then like we can like say that pin number one, I want to use it for input. Pin number five, I want to like use it to out. I can like connect switches to it, I can like connect leds, I can connect it to another devices and so on. So we cannot use it for input an output. So and also we can use them as I mentioned, to accept input and provide some output. And all of like these pins are programmable. Like we can write a program using like Python C or whatever to communicate with those pins. And also those controllers has for example, they have like adc, for example, like analog to digital converter. They have like interrupt handling. You know what is interrupt handling? Interrupt handling is a situation where for example we have like this setup, we have like a sensor that's sense the temperature in this room.

Speaker 1 29:06

So I can program program that controller saying that if the temperature exceeds twenty five, turn on the ac. So the sensors will like keep sensing the temperature. Once the temperature exceeds twenty five Celsius, it will send a signal to the control controller to turn on the ac. So in this case we have like interrupt hand. So it will like interrupt that processor. Right? So the process is like doing certain tasks. But when there's something important happens, I'll have to inform the processor like to stop working on the current process and then handle that interrupt. All right, so that's why like all of like these controllers support interrupt hand. So it will like based on certain conditions they can like interrupt the processor, tell them like hey, you have to stop and then hand it that request. So for example, like as I mentioned, we have twenty five degrees here in this room.

Speaker 1 30:17

So based on our program it will like give instruction to the pursuer like to do certain tasks. For example like send a signal to AC controller to turn it on. So we have like this controller can do that also it handles like multi input applications. So we have like input could be like using one of those pins and it could be like actually one of the steps of projects my students implemented last year was a smart cane. So you know, like for blind people, they have a cane. So we think about a smart cane in a way that we like implement a Raspberry PI or a controller that we can like connect a camera. So that camera can sense the surrounding of the cane. If like we have obstacles, then it will like inform, inform like the person that there is an obstacle in like nearby, like in the surrounding diameter. And it will like provide vibrations. Of course, like some people like they can't hear or can't see.

Speaker 1 31:35

So it will like start doing vibration on the cane to indicate that there is an obstacle like close by. All right. And also it has, it supports Google Maps, for example. It accepts the voice command, show me like give me the direction to the nearest grocery store. So the can will guide that person to the nearest grocery store by sending signals on the right of the or on the left of the cane to give you like, okay, I have to turn right, you have to turn left, and so on. So that was like a really good project. So in that project we use a Raspberry PI, we connect sensors, we connect cameras, and so on. It was very, very good project. So this is kind of pervasive computing application. Right. So we connected sensors. The sensor will be connecting the control controller. We like use get the information from the surrounding environment, process the data and then we can like send instructions to the controller to do certain tasks.

Speaker 1 32:46

So also it has output. So those pins as I mentioned, can be like considered as part of the output. For example, if I want to like send a vibration signal, so this considered as an out. Right. So once like we received the data and we say that there is an obstacle in like in one meter ahead. So how we can inform the person that to pay attention. So in this case the sensor is like sense, sense that obstacle and then we send a vibration signal to the king. All right. So that can be the vibration sign is an external device. So this controller cannot vibrate. Right. So vibration is another device connecting to this one. How we can it will be connected to one of these pins and then we can like send a signal from one of those pins to that device. Then it will start vibrating. So as I mentioned, these pins could be like considered as an input pin or an output input pin.

Speaker 1 33:49

It will be like received data from the sensors output bands. It means that it can like send Signals to other devices connected to this controller. So for the sensors we have like this is like the simple structure of those sensors. We have like that we have like many challenges with those sensors. Those sensors are tiny devices. So they have like kind of challenges. One of these challenges is like the battery life for example. Like we have not. Not all of the all like the situation that we have like power supply connecting to those sensors. Right. Smart watches now have like lots of sensors built in at sometimes that watch dies means that they need like power supply. So one of the challenges here on those things which is the battery life. All right, so especially for smart I O devices, how long one of these questions could be like how long long can my battery last?

Speaker 1 35:11

All right, that's why like if you again like if you want to buy some pervasive devices, you can find cheap one. When you can find expensive one, both of them will do the same task. But definitely the cheap ones will be like having problem with the battery. All right, so the life of of those batteries another challenge which is signal and power integrity issue. Because like those sensors, they have like interfaces. So how we can communicate with those sensors. So interface is very important. Based on the signal. Once like we receive input or once we receive like data from the SEN does, what is the quality of data received? For example, like if that sensors like use very narrow bandwidth. They don't have like enough bandwidth to send the data. Maybe like the data will be corrupted. Right? So if like the data will be corrupted or lost. In this case those sensors is not real.

Speaker 1 36:23

I need like, like for example we have like sensors can send accurate data. So the accuracy is like ninety percent, ninety nine percent. That's good. What if like the accuracy drops to seventy? Then in this case we have to think twice about using those sensors. Also EMI compliance and wireless confinements. Those are like how confident of like you using my design by relying on those sensors. All right, so because like these sensors will be like doing will be part of the design. So we have like to. We have to know all like the details before starting the design. So if you zoom in in any sensor, you can like find a battery module. They have battery and that connected to power management. So that will like give us information about how long that sensor will stay without power supply. And then we have microcontroller and then we have interface. That interface will connect to display or actuator or whatever.

Speaker 1 37:36

And then we have like analog front end that connect to from like converter from analog to digital and vice versa. So wireless conformance is we Want to ensure that the wireless devices, for example like WI Fi, Bluetooth, Zigbee, so all of like these protocols have like standard implementation on those devices devices. So we call that wireless performance. So we want to like make sure that all of like these sensors can follow the regulations of those protocols. So WI Fi, Bluetooth, Zigbee, lte, all of like these are wireless protocols and wireless structure. So any like any like sensor needs like to follow the standard of those protocols. It's important because we want to make sure that the device communicates in an efficient way. For example like if we have like if we have for example a group of sensors. So all like these sensors must follow the guidelines of those networks.

Speaker 1 39:00

For example like the, the maximum bandwidth, the minimum bandwidth and so on. So that's why like here for example like why it's important because we need like them to be all like the sensors are synchronized related to the wireless protocols that are using. One of the challenges, one of the challenges we have with the sensors which is the power consumption, the power drain. What's the problem with the power connecting to those sensors? So we have like as you see here like in this graph. So you can see that this is like oscilloscope monitor that monitors like the power or the current passes through those sensors. So we have like case of power draws. So we have like power supply. So as you see here like we have power supply. So that power supply can be because of hardware and software. So here is our problem, the problem with the power spikes. Okay, so as you see like here in this graph, okay, so we have like a steady power and then suddenly we have a spike of the power that causes a problem.

Speaker 1 40:41

What problem causing by like that power spark spike. So in this case this is like part of the design and that cause the battery to be like die pass. All right, so for example like there is a lifetime for the battery. If the battery has lots of spikes like that it means that it will affect the lifetime of the battery. So for example, if we're trying to minimize those spikes, what is the cause of those spikes? The cause could be hardware and software. Alright, so I'm not like a hardware guy. I'm not like electrical. I'm not like having like strong electrical background. I'm good in software. Who guys of you like have a good background in elect. I know like some of you is from electric. Can you give us like description of like what is the cause of that spark? Like if you don't know, that's fine.

Speaker 3 41:53

Power search. Sorry, Power search. Sudden search. Of power.

Speaker 1 41:58

Yes, exactly. So it has like for example, it affects on the power consumption. It affects the battery lifetime, as I mentioned. But I know like in software how to avoid those spikes. If you, for example, if you have a driver, you know, like any device has a driver. The driver is the bridge between that hardware and the operating system. I can describe it from like software side. So you know, like any device has a driver and the driver communicates between or like create a bridge between the device and the operating system. The operating system needs to know that there is a printer connecting to that computer. There is a camera connecting to that computer. So we call that a driver. So the driver creates like a bridge between the the component and operating system. If we have like bad programming for that driver, it means that we can like send signals to the processor to wake them up.

Speaker 1 43:09

So here is the deed what we have like safe mode for the processor. So if like the processor there is nothing to to do. They will be sleep. Is sleeping good or bad for the processor? Sleeping is good because we don't consume electricity. We don't consume power. You know that the processor has like lots of activities, thousands, even like millions instructions per second. So all the time they are active. Whatever it means active. It means that there is power consumption. Because there are cycles. They can fetch instructions from the memory. So the memory will be active. All of like these activities needs. It will affect the power consumption. So most of the time the recommendation is whatever, like where we don't like have anything to give, the processor will keep it slow. Keeping it slow. It means that there is no power consumption. If I like badly designed that driver, it will keep the processor awake.

Speaker 1 44:17

All the time the processor is awake, it means that lots of power consumption. So that's why there is a software and hardware for that problem. So I describe it from software because I know what I'm doing there. I know like I have good background in that part, but in hardware like electric part, I'm not good. So please like forgive me about that. So but anyways, in electric, as you see like those spikes, those spikes are bad because it will like affect the the lifetime of the battery. So that's why like during the sleeping or standby. So if you leave the computer for a while, it will go for sleeping mode. Sleeping mode. It's good for the battery, as I mentioned, because all of like most of the activities of the processor will be like reduced or damped. The monitor will be damned after like thirty minutes. This can be programmed after thirty minutes.

Speaker 1 45:29

The the screen will be turned Off, Then the processor will be like in a standby. Then it will be like in a sleeping mode and so on. This is perfect. But during that sleeping mode there is a spike. That spike will affect the battery. All right, so this, like, this is show that during, like, like the sleeping mode, I believe like one of these figures during the sleeping mode or standby. So there microcontroller deep sleep. So the microcontroller controller is asleep and then suddenly we have a spot. All right. It's like similar to a person like who has a deep sleep and suddenly you shake them. The first reaction is like, what's going on? The same thing here. So this is the spike for the processor wins. Like there is, there is a new task for that processor. So that's why like this, like cause a spike for the processor to wake up. So what's the problem with the spikes?

Speaker 1 46:41

It increased the overall power consumption. All right. So that spike increase the consumptions of that battery. And of course, like, this is critical for IOT devices, for our laptops. It doesn't matter why, because we have large battery for IOT devices. This is a big problem because those devices are like, should be like alive without power supply for a long time. And all of like these parts will affect them bad. So that's why like, once we do the design, we have to be careful of those challenges. So we have like to carefully consider the architecture of the devices and the preferred devices connecting to that system. We have to make sure that the peripherals are like not causing the processor to be awake all the time. Because waking making like the processor awake means that lots of power consumptions we have like to take advantage of memory.

Speaker 1 48:00

Memory, clock, timer, low power state options. We have like all this stuff in any operating system. In any operating system, you can like have advantage of like memory state options of like the clock. Do you know how to change the clock of any like computer system so you can change the clock especially. Do you guys play games? Online games, Heavy games? You guys play heavy games? For those people that play heavy games, they change the clock. Why the processor remember, like the frequency. How we can, how we can measure the power of any processor? Five megahertz. Like for example, like this processor is three point two megahertz, right? That's like the frequency. If we want to convert frequency to time, it will like give us how many instructions can that processor can perform per second. For example, like three point two megahertz, it will be converted to six million instruction per second.

Speaker 1 49:13

So this processor can execute six million. Suppose that Six million instructions per second. It means that the process is very active. If I change the frequency, increase the frequency, it means that I want to like give booster to that process. It's like energy, energy drain. Why we have energy drain? To make it active, to make us active. If you want to hitting the gym, you need like to it to have like energy drop drinks. Why we have energy drains? To give us like more power. This is the same thing. If we change the frequency of any processor. If you change the frequency, it means that we increase the number of instructions that can be executed per one second. All right. So we give them boost. So that's why like in any operating system we have advantages. Low power state option, clock, timer, we can change the clock. That will affect the timer and the memory as well.

Speaker 1 50:18

So for example, suppose that we have like a large room. Suppose that we have a large room and then I'm sitting like in one part, in a small part of that room. Does it necessarily like to make that room on? No, just the area where I am. I can like turn on the light and that the rest to be dark. No problem. In this case I can save power. The same thing here. If we have memory like for even like for those microcontrollers, the memory is very short and very like very, very limited. So if I like I give access to all of like the elements or the cells in that memory, it means that it will increase the power consumption for that system. For example, like if like I'm using half of that memory, so then it I can like dedicate the power to me for that half only. Look how, how deeply we reach. So we can control the memory by specific part. I'm like, we'll use this part of the memory, so give me power on that part only.

Speaker 1 51:33

I don't care about the risk. The risk is free. So they need like to give power for the rest of the memory. In this case we can like reduce the power consumption. Because remember power consumption is the main key for those devices for those applications. You know that now drones, now drones like everywhere, like especially in, in wars, wars can start with the drones. Now what, what like the advantage of giving like this drone the ability like to travel thousands of kilometers. The battery, the battery technology is everywhere. I can load with that drone with anything. But the main key is the battery for how long that drone will travel. So we have to be very careful with the power consumptions. So you can like think about power consumptions by like certain tasks. Don't think that my application even like with writing the code, the way you write the code, it will like cause harm or something.

Speaker 1 52:46

All right, so the power consumptions could be like the memory, the clock, the timer of the processor, the low power state options and so on. All of these will affect the memory consumptions. Guys, when we'll have a break today? Now it's ten. What do you think when you need a break? Ten thirty in the middle. Okay, ten thirty. So we'll take, we'll take a break in ten thirty and we'll resist like fifteen minutes of break and then we'll be back. Okay. It seems like you need a break right now. I know it's Monday morning after a good weekend, but anyways. Okay. Excuse me, guys. Still, the break is still there. Not now. All right, so that's why like, guys, once like we think about the design of those iOS system, we have to be careful, like select those options especially with power consumption. Then all of like these tips mentions, like the power consumption.

Speaker 1 54:24

All right, and here like we can have. Yes. So the next step, which is. Can be like I pick the design which is the. The. The prefer which is connecting the. Those devices are connected to the microcontroller are breaking the system. For example, like when I mention. So guys, all right, I don't like to talk over people, okay, if you have a question, you can ask. So any system, it's not just by the microcontroller. So we have like sensors connecting to that system. We have peripheral devices connected to that system. As I mentioned in a smart cane in this lecture, we like connect vibration device that is connected to that microcontroller. We connect sensors, we connect cameras and so on. So many external devices could be connected to that microcontroller. So we have to study the capabilities of each device that connect to that microcontroller and how those devices will interact with that microcontroller.

Speaker 1 55:43

What I mean by microcontroller is either like the Raspberry PI or the Arduino device. We call that microcontroller. All right, so for example, if the vibration device is ready twenty four over seven, it means that it will like consume lots of power from the main. From the main power supply. In this case, it as a part of the design, we have to reduce the power consumption. Now there is no problem with the processing capabilities. All the processors doing it great to process the data, manipulate the data. There is no problem. But still we have a main problem with the power consumption. So that's why like all our target is save the power. Saving the power is our main challenges. It's not just with the microcontrollers, but when the device is connected to that microcontroller. And here we have, we have a comparison between different microcontrollers.

Speaker 1 56:50

So by the way, what is the difference between a microcontroller and Raspberry PI? For example, you know that we have microcontroller. All right, so those microcontrollers, they have the ability, they have processor. So as you see here, like those are like different brands or different types. So with the name and so on, each one has flash memory, one of these chips, and they have clock speed, we have RAM and so on. So in microcontroller, the difference between microcontroller and Raspberry PI, for example, this is a Raspberry PI. This one is a Raspberry PI. Okay, so the, the difference between this one and those controllers, they have the same. They have like processor, they have memory. But here like we do have, have for example, ports. For example, we don't have like monitor ports, we don't have keyboards and so on. So here like you have usb, USB connectors, we have hdmi, HDMI connectors and so on.

Speaker 1 58:09

We have network cables. So this is like fully computer system. But those microcontrollers, they have just processors, memory, we call them flash memory. Some of like, some of like projects, they have like kind of different brand, those memories. The clock speed for the microcontroller is sixteen megahertz. For example, this one is sixteen megahertz, this one is twenty five megahertz, one hundred twenty megahertz. Maybe like if you want to convert, compare it to Raspberry PI. You can find that Raspberry PI has like two point nine gigahertz. It's way too much processing capabilities for the Raspberry PI over controller. But why controllers are exist because they are small in size and price. So the price is like very, very reasonable. All right, so they can like, they can like do the job faster because Raspberry PI, like full system maybe.

Speaker 1 59:19

Like, we don't need services that exist in Raspberry PI. So that's why like we prefer those micro controllers. So we have like three different. And of course like if you visit that link, you will find lots of microcontrollers listed and each one has their own. But this is like mainly the common characteristics of those microcontrollers. So we discussed about the memory usage and memory type that affects power consumptions in the market. You can like different, you can find different types of memory. The size can affect the power Consumptions. For example, like if we have this classroom, it needs like three rows of LED lights. If we have bigger room, it means that we have like more lights to be used to for that room and so on. So whenever like the size affects the power consumption and again as I mentioned, if I'm not using all the, all of the size in that memory, then like that programmable.

Speaker 1 01:00:27

Programmable, you can like reduce the power consumptions for that memory. Also the clocks and timers in the microcontroller module will also affect the battery rundown. So that's why like we have safe mode in all of like these computers and microcontrollers. Safe mode it means that when like there is no activity for the process processor or for the microcontroller, it will like enter in a safe mode. Same mode, it means that it will like then all of like the activities for that microcontroller controller disconnect with the preference. The preferred devices reduce the microcontroller active the processor activity and so on. All of these actions, it will like affect the battery runtime or like lifetime. So we have like different low power modes for the microcontroller. We have idle, we have sleep, sleep hibernation and so on. So I have like different states.

Speaker 1 01:01:36

So each one can affect the power consumptions in a different way. All right, so we can like look at the difference between them in like another lecture. Sensors can never go to sleep mode unless their communication is discontinued. More synchronized with the microcontroller. All right, so for example, like if sensors can we like do sensors to go to sleep mode? Yes, we can do that. Unless the only synchronized with the microcontroller. Synchronized in which way? For example, the microcontroller can say that I'm in a safe mode and I will wake up every five minutes. So we can synchronize that saying that when I wake up as microcontroller I need to pull the data from the sensors. So that's it. So the sensors can do the same if the microcontroller into sleep mode. Sensors will go to sleep mode as well if the control microcontroller is awake. So they can like pull the data.

Speaker 1 01:02:44

So the sensors will wake up and pull and still gather data as well. So that's why like this what we find, sensors can be synchronized with the microcontroller in the same. So both of them are in the same page. So this is like the different power modes in microcontroller. We have active mode. This is like the active mode which is the power consumption is High why? Because the microcontroller is active doing processing the data and so on. So the power consumption is high. So what is this on the cpu? The preferences and the clocks. So the clock is what we buy a clock for those microcontroller, what the flow does. So the block guys deepest signal to the microprocessor to start working. For example, remember, you have to understand the concept here. So how we execute instructions, how the processor execute instructions. So the processor fetch information from the network decoded.

Speaker 1 01:04:19

Have this example. It's good to understand what's going on. So for example, like if I have. So this is C. Okay, so we understand what's going on there. So we have a variable called X equals ten, Y equals twenty, Z equals X plus four. We know the answer, right? We know what will be displayed on the screen after we execute this instruction. But how internally those instructions will be executed? What is going on, like behind the scene, under the hood. All right, so you know that this is the processor, this is the memory. And once we compile the program, what, what is the meaning of the compilation? So the program will be loaded in the memory, right? So that part, the three lines will be loaded in the memory. All right, so in the memory. So the pilot will find the free space in the memory to define a variable called X and then assign, of course, like ten will be converted to binary.

Speaker 1 01:06:04

Okay, but let's assume that it's ten and then the compiler will find the three space in the memory, call it Y and use twenty eight. Of course, like the, the memory doesn't have X and Y as address. So we, all of us know that. So we don't have X and Y, we have address, right? So start from zero to the max of the memory, for example, sixteen gigabytes. So X and Y for us as ladies to know what about Z? How we got Z equals X plus Y. All right, so still now, so the processor doesn't have any interaction. So the processor is there, doesn't know what's going on there. So how that processor will be interacting. So once we have this instruction X plus Y, then the processor will like, okay, say that, okay, there is instruction here, There is another instruction that add X comma Y. Syntax. All right, so internally the compiler will interrupt this line, something like this.

Speaker 1 01:07:28

So now the processor will like access that information, something called pitch. It will fetch that instruction, okay, so it will fetch that instruction inside of the system. So this is, we'll bring it here inside the processor. So the processor understand that there is add. It means that I have to add something. Add what? Add the content of X. So the processor will travel back to the memory to get the value of X and bring it back in the processor. So ten will be saved here. All right, so and then the processor needs to know the value of Y. So the processor will go back to the memory and get the twenty and bring it back. So here is one where we save them an internal registry inside the processor. There is tiny registries inside the processor. We save this information, then we need to add them. Inside the processor there is something called arithmetic logic unit.

Speaker 1 01:08:39

They read the two values and then add them and then they save the result thirty. Then thirty will be returned back and we send it into Z into this location. Then the compiler will take Z and save it into X and it will, sorry. So this is the value ready for Z. And then we can like use print F Z. So Z will be printed on the screen. All right, so this is like the relationship between the memory and the processor. Back to our claim, which is the clock, what is the pl? So you need, you know all of like these traffics between the processor and the memory. So we have like cycles. So any instruction here be implemented in three sizes. Pitch, understand and execute. Pitch, decode, execute. It will pitch the instruction from the memory. Decode it means the understand it here and then execute. Execute that instruction. So any instruction can be implemented in three steps.

Speaker 1 01:09:46

Fetch, execute, execute. Sorry. Fetch, decode, execute. The rest it. If the clock is inform us how the processor, how fast the processor will like go to that to fetch that instructions. If the clock is, is like normal, the processor will accuse normal node for the execution. If I increase the clock, it means that I increase the frequency. All right. So the processor will like use full speed for the execution. All right. So that's why like here we use block to describe how the processor will like execute instructions. If the clock is normal execution, that's fine. It's like normal speed. If I increase the clock, it means that I increase the activity of like the speed of the processor to execute and to fetch. Execute, sorry, Fetch, decode and execute. So back to the active mode. So the power consumption is high and the use case which is normal operation processing.

Speaker 1 01:10:58

So the processor is doing their normal job. So next is idle mode. Idle mode is like the power consumption is moderated. What we like use in idle mode. So the peripheral devices are active while the CPU halt. Can you guys give us any case to describe that situation? The CPU is halted while the preparer devices are active. Can you guys think about Any case that describes that part, the CPU is halted while the peripheral devices are working. Yes. Could be something like this. For example, I'm playing. I'm like starting a game. The game is loaded in the memory. So when I click on the icon of that game, it's loaded in the memory. The processor is like not interact with it. Like the pair doesn't start somehow. And then like the processor is like stuff it's not interacting with with with the memory. Another example is I have like microcontroller connect with connected with sensors.

Speaker 1 01:12:26

All right. So the sensors are working sensing like that temperature simultaneous continuous sensing and sending sending data. But I'm not receiving. I'm not. The processor is idle. I'm not interacting with the data is like sending by those sensors. I'm like just ignoring whatever. Like for example, I have, I have a worker. So like like you do your work. I'm just here watching. Like I'm not a driver. Like you don't need like any data from me. Like no, just keep working. Just watch. So in this case the sensors are.

Speaker 3 01:13:08

Working.

Speaker 1 01:13:10

But the microcontroller doesn't interact with it. Like doesn't pull any data from it. Okay. It's like the camera, like monitoring camera. They are monitoring twenty four hours. But I let them work like this. There is no program that for motion detection for nothing. Just they are running, doing like even like without recording. We can like find dummy cameras. You can mount them. The cameras that turn on evil, there is nothing. They're connecting to the system so that they are connected. But the controller doesn't. Doesn't worry about them interact with it. So we call that ideal mode. Waits for interrupts to resume processing. What it doesn't like if we take the examples of like monitoring like surveillance cameras. So if we have like motion detection. If like the camera situation sense there is a motion it will send the signal to micropers like listen, I have some weird stuff going on.

Speaker 1 01:14:19

Wake up. In this case we collect waits for interrupts to resume process. Okay, so we can control that. Idle mode. Sleep mode. Power consumption is low. RAM and timers may stay on city use. But here like CPU is halted. Halted means that I'm like, like I'm halted means that I'm like working on the minimum means that it's halted. But in this case sleeping mode CPU is off. Off it means that it doesn't. Doesn't work at all. There is no activity for the cpu. But Raman timers mess. They are RAM is working, the timers are working and so on. Use case short term standby. We use it for short term standby sneeze mode lower than sleep. Here like I can select which resources are wake up which resources are like asleep. For example I can select that I want like just analog to digital converter is like waking up while like the other resources are asleep. And the same thing here while waiting for a specific peripheral triggers.

Speaker 1 01:15:45

For example if I'm using monitoring system I don't care about all the other peripherals. So I need like the camera send me an other alert or trigger to wake everyone or like wake the person. Deep sleep, long very low hair, like everything. Some memory locations will be like awake hair. Like long sleep between periodic tasks. So if I have periodic tasks, for example like I have a system that it will like sense the temperature every one hour hour. So why I keep everything awake. So let them like go to sleep mode. And then every one hour I wake up everybody and then like okay, let's walk, let's get the current temperature and then go back to sleep. This is exactly what like some systems do in like especially in farms and so on. I don't have like to sense temperature and like since the the soil or whatever every second I can like sense it every like day or every week or whatever.

Speaker 1 01:16:53

So why I keep the system wait twenty four seven at certain time I can like wake up the gut system to sense the temperature and do the process and so on. For example like here ultra low shutdown mode we have like minimum power consumption, no long microcontrollers fully off. And this is like where all of like the devices or like the system will be off. So it's important for us to understand those modes that will like help us with the design of those systems. For example like for any pervasive system we need like to fit the design. And in this course we have to learn how to design those systems. It's not just connect sensors and that's it. No, that's not the case. We have to understand which situation I have like used which mode. So so here like we have some choices. The best choice is we want to optimize the microcontroller clock speed. We have to optimize that microcontroller because optimization increase that effect on the power consumption.

Speaker 1 01:18:22

So one of these choices is like to configure the device display update rate. So even like the display it will like it has a read and pick one C and the way you have like that pick one C will like affect the power consumption. It will increase the frequency for the display so if you like check the display settings. For example, if you like look at the display settings here you can find frequency. I don't know where like you can find it. But what's that advanced this. What is that? Oh there. Look at this. So disk the mode is sixty hertz. So this is the frequency of the display. What that means, can, can anyone like give us like a description description of like that reading? For example like the display. This point is sixty hertz, what that represents except sixty frames per second. So once we display something like. Once we display information on the screen, we need like to handle how many frames per second could be displayed on that screen.

Speaker 1 01:20:12

So for example like if you watch a movie, a movie, for example, like now we have like three D movies and so on. So they have like say that for example like this monitor doesn't like doesn't support three D rendering. So we have like specially glasses. So the frame is like how, how many frames per second represent the sixty here. So for example like this stream supports sixty frames per second to handle like the data wants to be displayed or wants to be rendered on that, on that system. So in this case display information is important. If you want to like increase the frequency, it means that that will like affect the power consumptions. And also we have for example leds. For example like how we like receive the data from the sensors. How likely the microcontroller will receive the data from the sensors. Based on what if like the microcontroller will like always awake to pull information and receive information from the sensors.

Speaker 1 01:21:25

Of course like that will affect the power consumptions. And so all these things will affect the choices that we like to select for those devices and how we can transmit the data, how the data will be transmitted from that microcontroller to other devices. The frequency of the transmit of those data will affect also the power consumption as well. Also we have to make sure that all of like the peripherals that connected to the microcontroller are in in good shape. In good shape means that they have like to follow certain scenarios and remember like all of like these things will be affect the power consumptions. All right guys, so we'll take a break. So it's ten thirty five when we. When you guys will be back. Fifteen minutes. Fifteen minutes to break one.

Speaker 3 01:22:45

Check. Hi.

Speaker 1 01:23:35

Hello.

Speaker 3 01:23:45

I tried to find room for you by clarifying.

Speaker 2 01:25:19

Aspect.

Speaker 3 01:25:23

To our program.

Speaker 2 01:25:24

That's what we going to talk. Let's see what comes out. If we agree for us then I can ask you also to miss. Did you talk to no okay I'll text you okay all right I'll just give you a text about the missions office and other person thank you. Yeah we can do an online meeting I will just search something Bye bye Take care. Take care.

Speaker 1 01:26:36

It's.

Speaker 3 01:27:11

I'm thinking going down or going that side I think I go that side he mentioned the project deliverables for project proposal on this line here going home or stay here for no, I'll stay.

Speaker 2 01:27:35

Here at twelve I have to.

Speaker 1 01:27:42

Come with me.

Speaker 2 01:27:45

There is actually one do you know where is Michelle's office? Just.

Speaker 3 01:28:01

Sorry yeah I'm looking for Khushi I don't know where she went out.

Speaker 1 01:28:07

I think she has went to the.

Speaker 3 01:28:08

Washroom yeah.

Speaker 2 01:28:17

No the chef office is on fourth floor this building Just go and check out with her I mean I don't know if it's he or her Just go and check out that.

Speaker 3 01:28:26

Person so maybe walk in and talk.

Speaker 2 01:28:30

To her yeah just go and check out It's a break right now yeah just go there and see the walk in timers and stuff find out the.

Speaker 1 01:28:38

Things.

Speaker 3 01:28:40

I I'm still checking on the cost available program available on the website.

Speaker 2 01:28:48

So are you not finding the programs available right now?

Speaker 3 01:28:52

Yeah I'm checking in I'm checking just seven I already have two subject in mind but I need one more subject.

Speaker 2 01:29:02

To check okay so you have something in the already have one for were.

Speaker 3 01:29:10

In my but there are two more two or three yeah all right I.

Speaker 2 01:29:19

Don'T have any single not even a one that's what we are going for we have completed like this will be our seventh course day completing right now.

Speaker 3 01:29:29

Right now.

Speaker 1 01:29:34

What are you guys doing here?

Speaker 2 01:29:35

Time there's a huge mess I'll tell you when when there is a lot.

Speaker 3 01:29:39

Of time yeah no problem I know along.

Speaker 2 01:29:51

Everyone is in dilemma in their life we can skip the semester what.

Speaker 3 01:29:56

Is wasting our time right?

Speaker 2 01:29:58

Yeah so their life will be offering courses in winter and you can complete the winter and course require members of sixteen months and we cannot do that Corre yeah so we tried everywhere and nothing is working out so we going to do and we are going to request him with the courses let's see what comes out I just something positive I get something positive.

Speaker 3 01:30:21

He has to.

Speaker 2 01:30:22

Do something no he's not going to do anything he send us directly coordinator we have been program coordinator assistant and.

Speaker 3 01:30:30

Everyone.

Speaker 2 01:30:40

It'S not just me who There are forty more people lying in the line along with me and we still not taking any decision in our favor so we five people decided that we could go and talk on behalf of.

Speaker 3 01:30:56

Everyone and make a further in the same program for three more courses.

Speaker 2 01:31:01

We need three more to complete Our this one bachelor masters subject was the data mining and was a system that's not bad but one out of five.

Speaker 3 01:31:26

One hour.

Speaker 2 01:31:27

Yeah one by five. Oh because of that the composar is.

Speaker 3 01:31:37

Not so.

Speaker 2 01:31:40

He did two research projects one in implementation four quizzes and five assignments in the entire course like super hectic. So that's the reason majority students wanted it. They dropped in and they had a huge loss for that person. Now they are like I think they're not offering any system elective and we all are pending system elective right now. So we have three options. And then at that time they had told us that we will be having two more electives along with the the data min. So at least one will be offered. So now they like you could have finished your course curriculum with data memory and everyone dropped in. Now we all have subject.

Speaker 3 01:32:27

Everyone is pushing Dane and all the coordinators. They probably realized that what we discussed discusses out there.

Speaker 2 01:32:37

And data mining is not so relevant to us. We chose that we can do to the other questions real time data analytics and stuff. So they're like no whatever is elective you should go with that. Just. Just make sure that the first thing is the ten years before that this.

Speaker 1 01:33:00

Is going to happen.

Speaker 2 01:33:02

We all assuming that we would get at least one elected in summer and we could finish it. This is not my. This is just an elective. This is not a full course. We thought that we could get one and we could finish.

Speaker 3 01:33:25

This semester man. Even summer we just cope with it. We have to extend our study because of that.

Speaker 2 01:33:44

You should be focused. Nobody study data by name because.

Speaker 3 01:33:50

The.

Speaker 2 01:33:50

Students as well as the feedbacks and stuff. There's so many things even it depends on the interests of people as well.

Speaker 3 01:33:56

Right.

Speaker 2 01:33:57

So you should be offering at least two and then make this you know thing like it's. It's your failure at your end. Because we had offered two electives and we didn't even chance to maybe do one and okay in that also we tried to register half an hour register registration seats were full and some people were not even able to register Even after dropping the website was not changed.

Speaker 3 01:34:30

We couldn't get in within two hour all the seats are taken out. Then not many people.

Speaker 2 01:34:42

Accordingly people. But he like no it's not our fault.

Speaker 3 01:34:47

Your fault.

Speaker 2 01:34:50

I don't know why they are behaving so crazy. This is the current thing going on right now. And we are super stressed that if we don't have any course in the then we have to sit empty and nobody's offering a job for four months complete job so we don't even have an option and stuff they doing nothing.

Speaker 3 01:35:14

That'S not okay that is and we send the really really no even if.

Speaker 2 01:35:21

You do that it will be a big gap in our resume since we'll not be having any jobs and stuff.

Speaker 3 01:35:27

Beside our responsibility our fault and we.

Speaker 2 01:35:30

Also given them option like if you're taking a break then you have to give us a letter your that's what we are going to call today talk to them but before him I think if you have a query regarding the certain electives I think you can go to the mission in SP I the.

Speaker 3 01:35:55

Same program before I can get back.

Speaker 2 01:35:58

Alive I told you right? Forty people are pending with only one elective some are with two and some with like three and some like forty are the total forty. Forty people and still they're not deciding anything it seems like there I don't.

Speaker 1 01:36:18

Know.

Speaker 2 01:36:20

Because we didn't take and they had a huge loss of data mining. Right?

Speaker 3 01:36:24

Yeah it does coffers s fault, not people's fault.

Speaker 2 01:36:29

And even even though I didn't get a seat and I just sat in this class in the first class itself he was like seventy five percent is a passing score. It's two quizzes, two research papers and one implementation. Okay, thank God I didn't take it.

Speaker 3 01:36:44

Oh, so you just drop it.

Speaker 2 01:36:48

I was like I cannot afford that much of stress right now. It was a winter as well and I already had three more subjects so I was like I'm not going to take this stress right now. After seeing the ratings and stuff and comments and everything it was like I don't have a good foundation programming and data mining programming and stuff machine learning and stuff. So that's what we are going to ask you. What what's going to happen but before that I think you can go to them and then you can put an draft an email to program coordinator so you can do your yeah they do respond to email but sometimes they are good with the responses and sometimes they're just giving you the V responses with no end solutions.

Speaker 3 01:37:37

My friend already did that like general information.

Speaker 2 01:37:43

You don't get any response for this they will give you this kind of responses.

Speaker 3 01:38:09

No answer like it's gentle and then.

Speaker 2 01:38:12

Oh my God another response. We asked for the thing.

Speaker 3 01:38:25

Oh okay.

Speaker 2 01:38:28

But still now we didn't get any response from Please email I emailed them you did that.

Speaker 3 01:38:35

So now you guys are appointment.

Speaker 2 01:38:38

He didn't give us any yes or no. Okay. So we are just going and working a one minute problem because we don't have a time and one person just has one course left and he has already taken nine courses. If he doesn't take the course then of course his degree requirement will not be met by this point.

Speaker 3 01:38:57

So.

Speaker 2 01:39:00

The people here.

Speaker 1 01:39:03

Yeah.

Speaker 2 01:39:04

How could you do that?

Speaker 3 01:39:05

Before I come to this school is quite good. You want to take this? Yeah.

Speaker 2 01:39:26

This one professor is really sick. I just hope these two are offered and I have made up my mind since I'm from software background if I learn something about safety critical that would be more better than learning data mining because I have chosen software as my mainstream. Right. So I do.

Speaker 3 01:39:44

I think more of the software related. Right. I think this is good. I. I'm also hoping to get this car but this an offer. Right.

Speaker 2 01:39:54

How much time do you have?

Speaker 3 01:39:57

Five until next July.

Speaker 2 01:40:01

When did you start the course?

Speaker 3 01:40:03

January.

Speaker 2 01:40:04

This January.

Speaker 3 01:40:05

All right. Two more semester to go.

Speaker 2 01:40:08

See many of us are relying on this courses to fulfill our degree requirements and to successful. Not my side. Somebody had emailed the other program dean assistant system and stuff. So they got. They wrote everything and then they didn't receive a proper response from that end as well. That's what forty people are there? Not me.

Speaker 3 01:40:37

Yeah, yeah, yeah.

Speaker 2 01:40:39

I'm very young. Think about the strength.

Speaker 3 01:40:41

When I saw the le I said what?

Speaker 2 01:40:44

And the worst part is they have changed the entire curriculum for the next batch. Twenty twenty five batch we are the one that is pending with data analytics and the next batch will not be having the issue because they changed the grad calendar for next semester. So now they have made project management as a core course. Ethics has one core course and maths has a core course for. For software engineering.

Speaker 3 01:41:13

All right.

Speaker 2 01:41:14

Yeah, but we had different three core courses.

Speaker 3 01:41:17

Is it?

Speaker 2 01:41:18

Yes.

Speaker 3 01:41:20

Start from which which semester.

Speaker 2 01:41:23

Now for the batch which has come in twenty twenty five they have changed the grad calendar. I mean you your twenty twenty four.

Speaker 3 01:41:30

Twenty twenty four four.

Speaker 2 01:41:33

And they have changed for twenty twenty five. January.

Speaker 1 01:41:35

Yes.

Speaker 3 01:41:35

My course different. I don't have data. My core course.

Speaker 2 01:41:40

Not this my core course. It's my system and activities. I have three options.

Speaker 3 01:41:46

Software and program. Software and methodology which I haven't taken yet. I'm planning to take your with them then Max, you're right.

Speaker 2 01:41:55

Ethic program program will be in full program Project management. I think if John is offering you he's a very good teacher.

Speaker 3 01:42:05

I already taken in the very first semester.

Speaker 2 01:42:09

I think so.

Speaker 3 01:42:09

John Frost. Yes.

Speaker 2 01:42:11

I think yours was the best project. You got the dreams reward also.

Speaker 3 01:42:16

I remember that we won that.

Speaker 2 01:42:19

Yeah, yeah, I got that.

Speaker 3 01:42:20

You also in there?

Speaker 2 01:42:22

Yeah, I was in that course by the way. But the thing is my. My teammates gave up on us. Only three members were working me.

Speaker 1 01:42:30

One more guy.

Speaker 2 01:42:31

That is seven after seven. Only three were working me, Mark and one more. Everyone came up at the last moment and did the touch ups of the jobs.

Speaker 3 01:42:42

That's awful.

Speaker 2 01:42:44

I did most, Mark did most and Safe did most. That's why our project didn't meet the requirements at the end.

Speaker 3 01:42:51

I understand fingers are important. Yeah, of course.

Speaker 2 01:42:55

Even if you don't know the stuff, you can ask the people, you can make up the time.

Speaker 3 01:42:59

You can come together and give your.

Speaker 2 01:43:02

Ideas of how to resolve it.

Speaker 1 01:43:04

Right.

Speaker 2 01:43:04

Nobody did that. I did it. That's it.

Speaker 3 01:43:09

You guys push them also make it income.

Speaker 2 01:43:17

Yeah. So since we were the not the one who chose the tree, it happened anyways. Even if we I would have chosen. I would have not known that what team I would choose because many of them were unfamiliar faces.

Speaker 3 01:43:34

That was my first semester.

Speaker 2 01:43:35

Okay.

Speaker 3 01:43:36

I didn't know. Luckily, luckily the team I had three.

Speaker 2 01:43:41

Subjects in that semester. I think image processing is a special topic and this one and software studio. If Abdullah Akbar is offering you software studio, he's very good at it. He teaches all the industry stuff and even if you don't learn something, you will know what it is. Microservices, agile, AWS deployment and everything. He will teach you software Software studio. I will see the code. I will and text you all the courses. Foundations was offered by Sana so even she is good. So I didn't focus much on the classes because even in that team also my team of teammate gave up on me.

Speaker 3 01:44:27

Oh my gosh.

Speaker 2 01:44:29

That has been a consistent thing happening for me for the past twenty.

Speaker 3 01:44:33

Don't worry, our team, we will try our best. Okay.

Speaker 1 01:44:36

Yeah.

Speaker 2 01:44:37

That's what happen. And I think in one more course. What was it? I just took the name right? Image processing in that also my teammates gave up on me and at last moment I was sick like this even way far worse than this. And they just took the credit. Wow. So I had suffered a lot that time as well. I was like come together with finish. It was like some giving a mini lecture on certain topics of your choice. We chose image registration and stuff. So we tried to do it but nothing came out. They worked on very last day they made PPT and they were like we did everything. Wow.

Speaker 3 01:45:26

Oh my God.

Speaker 2 01:45:28

But I think too much. Finally that was not a good team.

Speaker 1 01:45:34

I.

Speaker 2 01:45:37

That's what happened so far. So I struggle a lot with the teammates and stuff. Even if I don't.

Speaker 1 01:45:41

If.

Speaker 2 01:45:42

Even if you don't know the st. You can come together, right? And resolve.

Speaker 3 01:45:45

Don't know. Never mind. Just participate in the meeting that is discussion.

Speaker 2 01:45:50

But I had something software studio. Chinese teammate was there. She was really good and we worked together. Whatever. Even I didn't know the stuff. She knew many things. My husband was also knowing many things. Since they both work in the industry. So yeah, they helped me. And at least even if I don't know how to execute and run the things we collaborated at the one best level came up with one solution.

Speaker 1 01:46:17

Yeah.

Speaker 2 01:46:17

So that was a good team. And one more development and tools was a good team.

Speaker 3 01:46:22

Going down?

Speaker 2 01:46:24

Yeah, I will go down. Okay. Yeah, I'm good now. I'll go with the dog next to that.

Speaker 3 01:46:29

No problem. That's why I want to give you. You can return to me the next day.

Speaker 2 01:46:32

Actually I have so many in home. But this area has become too sensitive. If I apply so much then it work. It will burn and over. So that's how the things happened so far. So yeah, that's how.

Speaker 1 01:46:46

That's it.

Speaker 2 01:46:48

And now I'm left with three more courses.

Speaker 3 01:46:52

Oh, I think is seven.

Speaker 2 01:46:54

Yeah, I'm done with seven. This is the seventh month I took one in spring and one in the summer. I didn't have any choice to take advanced optimization. I didn't like that.

Speaker 3 01:47:05

I just know who and no we were this summer. Summer. Now they regret it. They say it's so hard. It's a professor professor giving giving them a tough time and oh my God.

Speaker 2 01:47:21

Thank God.

Speaker 3 01:47:21

God is.

Speaker 2 01:47:24

And I'm not good at ML stuff. To be very honest, I am very good at that.

Speaker 3 01:47:28

I'm very poor at mad. No, no matter what. Even engineering I don't know how to do calculation stuff.

Speaker 2 01:47:37

So I need to learn that everything from scratch as well.

Speaker 3 01:47:40

So let's see what quality management they say that is good quality management.

Speaker 2 01:47:48

Actually that's my not even elected. So I cannot take that score.

Speaker 3 01:47:52

That's all.

Speaker 2 01:47:53

Yeah. I think I have my friend who's going to take that. I guess I'm not sure. Well, I can ask him for you. You're taking the subject, right? If your professor is Dima.

Speaker 3 01:48:05

Wait, Dima. I don't like Dima is a lot of. Has a lot of say.

Speaker 2 01:48:46

Okay. I will also tell you that how to make mistakes. Also try to get. I will show you that.

Speaker 3 01:48:51

No problem. No problem. Actually I got app that I talk and then you. You just screen and all.

Speaker 2 01:48:59

I will help you with the study. Don't worry.

Speaker 3 01:49:01

No problem. No, we help each other.

Speaker 2 01:49:03

Yeah.

Speaker 3 01:49:04

I have some knowledge. You have some knowledge you can share together. It's not like one person do something. Right. We all have to learn together. Over. Welcome the. All right. Bye.

Speaker 2 01:49:18

Bye. Take care.

Speaker 3 01:49:19

Yeah, let them know.

Speaker 2 01:49:22

Let's. I'll text you in the group. Okay.

Speaker 1 01:49:25

Okay.

Speaker 2 01:49:25

Whatever.

Speaker 1 01:49:26

Right.

Speaker 3 01:49:27

Right.

Speaker 1 01:49:28

Bye.

Speaker 3 01:49:29

Take care.

Speaker 2 01:49:30

Take care.

Speaker 1 01:51:26

Thirteen. All right. So this is like the power consumption when the sensor will be like in standby. We know that what we by standby, right. Based on the previous table we provided in this picture. So the standard standby mode current is zero point two four milliampere running with all sensors disabled. For example, only powering led. So suppose that this sensor has an led. All of like the sensors in this component. This device is disabled. So it will consume that much out zero point three three milliampere running with all sensors at one hundred milliseconds per sample data. So this is like how frequency, how frequent. I will. I gather the data from that. That sensor. One hundred millisecond per sample. So every one hundred millisecond I would like ask the sensor to gather samples from the environment. Because I'm like if that's sensing temperature, every one hundred millisecond I would like ask them to sense the data and broadcasting at twelve point zero eight milliampere.

Speaker 1 01:53:25

All right. Then we have Bluetooth. So this sensor will connect to the smartphone through Bluetooth. And the Bluetooth is like, it's like protocol, networking protocol. It needs like energy to work. It will like cost us five point five milliampere. Inside that sensor there is like temperature sensors. If I want to use it, it will like use zero point eight four milliampere light sensor. Again, inside it there is a light sensor. It will extend the light. It will cost us zero point five six million here. Accelerometer sensor and gyro sensor. It will cost us four point six eight milliampere. Parametric sensor zero point five. All like these sensors. And this is like how much it will cost us for the power consumption if we want to use that sensor. So suppose that the battery of that sensor of that tank, it's a coin cell battery rated at two hundred and forty milliampere per hour.

Speaker 1 01:54:37

So that battery will provide us two hundred milliampere per hour. So we can calculate the lifetime for that battery that would like support that, for example, it will give us forty four hours. Hours. If I would like, if I want to like use one sense which is for example like the Bluetooth, which is five point one. All right, so for example like it will like this battery will stay for forty four hours. If for example, if I want to like go for the, the W two which is five point five. So we got can multiply. We can multiply. Sorry, we can multiply two hundred and forty times four point five. It will like close to that much hours that battery can go. So based on the technical specifications for those devices, we can measure the lifetime of the battery for that station. It's not like, no, we have like to know exactly how each component in that, in that device will consume power.

Speaker 1 01:55:52

And we have to calculate the power supply, what is the capability, what is the capacity of the power supply for those sensors and for how long it will stay. All right, so all like this information is from the specifications for that can find that information or line with the specifications of that component. And in this case we know, we have pre knowledge about the battery, which battery we want to use and which battery, for example, like how long that battery will stay. All right, so that's why like for the drones, I know like that battery on the drone will like with all of the functionality of the drone will like fly for two hours. If I like disable some function. It will, it will fly for two point five and so on. Because each option I will add, it will like fit the power. So that's what I care. Each one of each like sensors from that list. See how much like this.

Speaker 1 01:56:56

So as, as to summarize whatever like we discussed in so far for the sensors. So the key concern for the sensors as you see here guys, is like we have to configure the sensors to better use and to have like better good performance. It's not just we think about sensors like sensing the data, gather the data and that's it. No, there is like a big concern about those sensors because like their power consumptions, how interacts, how those sensors will interact with the microcontrollers in which way that's the key components for like dealing with those things. It's not just just to plug that sensor then that's it. No, there's lots of concerns that we need like to think about once we design any pervasive system. So the second part of this lecture which is smart devices, so we come ourselves sensors and we simply. This is like the related to simple sensors.

Speaker 1 01:57:57

Simple sensors are. Those sensors are like just collect data and send it to a microcontroller or whatever. Smart devices, those smart devices, you can find them everywhere around. So smart devices could be like smart services, mobile devices, a human control interface with the Bio Ixci. So because at the end we need those sensors to be part of assisted at that system. We call it smart. So smart system is like, consists of smart devices, smart services. And we need like a mobile device that communicates all get all of like these together and then we have like to provide that to the user. So that's why like we have D categories. So smart services, it's like obvious that we have a service and that service will like provide some benefits to the user. We need like smart devices that or mobile devices that gather that information, process it and present it to the user.

Speaker 1 01:59:07

On the other side we have like human interface, human computer interface that will take that information and present it in a good way to the user. So for example, for mobile devices we have like mobile host and so on. In mobile hosting we have like lots of categories like physical dimensions, type of like mobile host. We have animations, humans interactive, all of like the sensing information would be like top of the environment before, like around that device or around those sensors. We sense everything and then take the data and pass it and present it in a good way to the user. So as a part of having mobile services, what we mean by mobile services, that service can move and then can move from one space to another. And then there is no changes for the user by that move. So this one, one point of view, another point of view is like the user is moving and the service is fixed.

Speaker 1 02:00:21

So we call that distributed mobile service. So once like we. Because like nowadays if I have like a smart glasses, if I have smart glasses, it means that this is like pervasive, pervasive computing system. So how I make that definitely like I have, it's not like fixed, it's not like related to certain place. It means that it be connected to some distributed system. How we can describe that system. So the system can be like it has network infrastructure provider, so that system provides network infrastructure. It has computer devices that support that distributed system and it will communicate with services infrastructure. We need to build that service and individual users can use it. And of course enterprise can use. So this is what we mean by distributed mobile services. That service can be, it provides support, provides services to users and enterprises.

Speaker 1 02:01:40

It has cloud computing services in most of the cases. And of course like that's like based on computer devices and so on. For example, suppose that you are using one of the apps online games. So this could be considered as a distributed system. So the game, you can use it anywhere, right? You can use it at home, you can use it any place. So this is part of the distributed of that system, that application. All right, so you can lock. That service is available everywhere, anytime, whatever. Anytime you can like access that service in any case. So this part of the solution. All right, Another part is that game has an interface. We'll talk about that point in the next slide. It has an interface. You don't know what's going on behind that interface. Where's that location where like the data? What is like the parts of that game in which server you don't.

Speaker 1 02:02:56

If the server is down and then we take the data to another server, then you don't feel that the server was damped. So this is part of this distributed system. So we call that. That's why here Distributed mobile services is a very huge domain in software engineering literature. And most of the applications will follow these. It has network infrastructure. We collect provide that service over the network. It has computer devices, you need like computers and devices to add to create that distributed system. We have like service infrastructure providers. We have like big names that provide that service, like Microsoft Azure, like aws, Google Cloud and so on. We have like service infrastructure providers and we have individual users at the enterprise uses that service. So here like we can find distributed system void viewpoints. So how the user will view that distributed system.

Speaker 1 02:04:05

So for example we have like who use Google Docs. Google Docs is an application of distributed system. If you for example Google Drive you can create documents on data drive, you can create like Excel sheet, you can share it with others. That's a very good example for like represented the idea about distributed system. So from user view users can access information and can provide tasks. I can access my documents online. I can like access that information. I can access my saved file online from anywhere. See. So this is like the implementation of the distributed system. I can access it from anywhere. I can access from my laptop, from my smartphone, from like any device connected to the Internet. And I can like access the information. I can review the files and can perform tasks. I can like write great documents, I can read. I can like send it to someone else.

Speaker 1 02:05:19

I can print it, I can share it with others. So this is like the user view. So once we think about any system that become like design, we have to think about this deputy system. A normal user can access that service from anywhere, anytime. So network view, how the network view will look at that system. So in this case, network view, all right, can create networks and then connect to computers to perform some processes or some processing and computational and access the data. So network view that support that system, it should have like stable network in a way that the network exists between the user and that system. So for me to access my document, my Google Docs, I need a network. I need like WI FI connection, I need like some API addresses and so on to be able to read that system. So that's why we need network that communicates computers. So the network infrastructure here in this building has the ability to communicate with computers.

Speaker 1 02:06:37

Either those computers are like the servers or clouds or the user's computer. So we have the network that facilitates that process. And then we have Enterprise, Enterprise View, Enterprise View that sits like the policy for that system. So users can apply the policies. For example, I can share documents, I can have private documents not share to others. I can like share documents to edit, read and just. No, like just read and write and so on. So we can apply some policies, we can apply some rules. So the users can apply or like follow some policies and they have like some rules. Users, this group of users can read, this group of users can write and so on. We have like some rules and then all based on these policies we have like some services. So they use user a can like use this process, use this policy and apply this role to give or use some services.

Speaker 1 02:07:50

So the service platform we have like user interface. So for all like these distributed system, we have user interface, we have service processes and then we have like resource management system. So as an example, like Google Docs, they have like cloud computing, but they have a very good user interface that will facilitate that service. Behind the hood, we have service processes where like we have servers, we have like the files will be set in a memory, shared memory, we have resources. And based on like the pervasive, pervasive devices, we could like have sensors, information controls that control all of like these services. So for abstraction for distributed system, so any distributed system should be abstract. What mean by abstraction when I say that, for example, this micro is implementing abstraction. Abstraction means that it will like create an interface to the user in a way that the user is not involved in what is going on there?

Speaker 1 02:09:15

What is going on inside that device. We create interface. All right, did you guys use API before you guys use APIs? APIs is the same thing. API is an interface for a code or a service. I don't care about how that service was implemented. Just I need like to tell me like how I will use it and that's it. When you drive a car, it's not important to know mechanically how that car was designed or how was implemented. I don't care. What I care of like how to drive that. That's it. So we call that interface. We can find many interfaces around us in our everyday life. All right, so you can find lots of interfaces around us. So that's what we call abstraction. So abstraction is you can like use that interface without knowing internally how that service was implemented. We don't care. All right, so for example, the properties for the applications to be able to implement abstraction, we have access transparency.

Speaker 1 02:10:29

For example, like for Google Docs we should have access transparency. It means that I can access those documents from any location, from my smartphone, from my computer, from any smartwatch, from any device. So we call that access transparency concurrency. Like transparency is, which is I can like multiple users can access the same service. I can share docs with others. They have like access the same problem or the same, the same resources. Failure transparency. If like the server was holding my docs has a failure, then automatically we have a backup server. So the backup server will take off all of the loops and then the user doesn't notice that there wasn't any. So this is what we mean by failure transparency. All right, so if like something happened, if one of the servers one is down, so the user will not notice that there is like a failure in that system.

Speaker 1 02:11:46

So this is another characteristics of the district abstraction or any distributed system replication transparency. It means that if like one of the servers is busy, I can change the users like the coming users to use another server. All right, so without notice that the servers, the users, without notice that users will like have that move. Also I can like use replace one service in the server with another service without the user will like notice that service. For example, if I know that that service has a bug in it and I fix it and I replace it so the user will not notice that there is something change in that service. Migration transparency so permits like the resources to move during the. How. How we can move services on the moon. Do you know that you know object oriented programming, right? We know like do you know Java? You know that we can like move objects from over the network.

Speaker 1 02:13:07

For example, if I have an object called chair, I can create multiple objects. Chair one, chair two, chair three. You know that we can move that object as an object over the network from one computer to another. So I can move the data over the network without notice that those are like with that, for example, I know that this server is busy and overloaded. So I can move that part of the service to be moved another service to another server without the user will not notice that. All right. So that's why like we have it migration transparency. So even like I can move the service from one server to another. All right. For example, if I move nowadays like I'm working on Google Docs, so all of the documents will be near me. Even like I'm using the cloud computing service. So my docs would be like in a server in Toronto for example. But suppose that if I move to another country, do you think that still like I will lose the documents that saved in server in Toronto?

Speaker 1 02:14:21

Of course not. That documents will somehow to be moved to close by the country or the place where I moved to. All right. So of course like I will not send a request to Google team that please move my documents to that country. Of course it's nothing like that. But the system will automatically detect that you are moving to a new location and then it's better for the person performance to move your documents to close where you are. What do you think? Like why it's affecting the performance? Why this is better like your your files will be moved to where you are close to. Why of course it will affect the performance. In which way? Any idea in which way? Sorry? Exactly. So for example, suppose that I'm like in Toronto, but my documents in Vancouver, you know that like to request the documents you like to have to travel over the network. All right. And you know that based on the network theories, there will be like lots of loss and damages the package coming and going over that network.

Speaker 1 02:15:51

So if I'm using long distance routing techniques, there is a chance of data loss if that the data loss increased with the increase of the distance. Right? So that's why it's recommended like or like that the data I'm using because for example the redundancy for like parity check or whatever, it will be easy for us and it will affect the performance and we like I will use the full utilization of the network if the resources close but close to the destination, the source and destination are very good. So that's why like here migration transparency is one part of the distributed system scaling. Transparency, Transparency. Suppose that I'm having like an application and I assume that I would like have one hundred users access my application per day and then suddenly I the increase of users will use my application increase drastically. It means that I Have to scale my resources.

Speaker 1 02:16:58

And instead of like having this much space to handle the new increase. No, I will increase our expense the resources. So in this case, I will implement scaling transfers. Scaling means that the user will not notice that I increase the resources. All right, so we call that scaling transfers. So all of these forms should be implemented in a system to call it a distributed system. So we have access, transparency, replication, transparency, failure transparency, migration, scale scaling, and so on all of these phones, if it is implemented to assist them, we can call that system distributed system. So why? Why we are mentioning that? Because per passive compute is ninety nine of per passive applications considered as distributed system. All right? Once you have like a smartwatch, that smartwatch connects somehow to like server or whatever.

Speaker 1 02:17:57

All right? So it will like means that we need like what distributed system to handle it? Virtualization. Sometimes we need like virtualization. Virtualization. Did you guys, of course, like us? Virtual machine. What is a virtual machine? What is the idea behind the virtual machine? So all of us in like in the first class activity, we install a virtual machine, right? What is a virtual machine? So suppose that we have Windows operating system. So how we can create another operating system on the top of that? This we call virtual machine. Virtual machine is like you create a layer on the top of the current operating system in a way that I can can install another operating system on the top of that layer. So we have layers. So the virtual machine will like create a new layer on the top of that operating system in a way that will use the same resources or part of the resources of the virtual machine.

Speaker 1 02:19:05

So why we do this? So to make to save the original operating system. All right? So if something happened the virtual machine, it will not pick the actual operating system. For example, if I want to implement a new application and I want to test the new application, maybe like the new application, it will like, harm or make make like problems with the current operating system. So I would like to create an isolated layer on the top of the operating system that will like protect the original operating system from any port or from any damage. So that's why we call it virtualization. So virtualization is the ability to map components in the current machine in one interface. That interface is a layer that protect the original operating system. And it gives us the opportunity to use the same components. So in that virtual machine, I still can use the memory, the processor, the WI FI, or like the network protocol or network card and whatever.

Speaker 1 02:20:14

So virtualization is not necessary to hide or simplify or provide interfaces, but it will like protect the original Operating system from the original components from damages. So once like we think about the architecture guys and we have different models. So once like we talk about pervasive computing, it means that we need like to design some applications. Those applications of course it will like use the network usage and we'll use the cpu. So the network usage it will like have a spectrum from low to high. So once we talk about low network application or talking about monitor link application, it means that it will run without any connection to. It's like disconnected from a network. We don't have like high connectivity to any network. So this is like we'll use high resource access device. So the computer will have standalone activity that it won't connect to any resources outside that computer.

Speaker 1 02:21:31

So in this case we are looking for low network usage. For example, like chess applications, if you have like that game or whatever or calendar will have locally connected to the computer. High network usage, it will like use low resources in that device. But mainly it will depends on the resources over the network. In this case we have then the client, dummy client and all of like the load will be coming from over the network. And then we have CD usage. We have high CD usage. It means that application running locally on that computer. And that's why required high use of cpu. And the meaning of like high reuse of CPU it means that it will affect the power consumptions. And then on the other part of the spectrum, we have low CPU usage. It means that low resources access devices used for presentation to display information. For example, like if I want to display the game remote services and so on.

Speaker 1 02:22:47

And also one of like the models for designing the application, we have multi tier client service mode, we have monolithic mode, which is as I mentioned, all of like the stage. All the services could be like in one computer. All of the information, the processing, the services, all in one computer. We have three clients that connect to servers. So the three client will connect to servers to access for processing. So the server will do the processing fatty client where the client shares the processing with the server. Can you guys give us an example of fatty client server server or architecture? You can Google WhatsApp. WhatsApp. Okay, so it's a path client. Because if you look at the storage, it takes, it takes a lot of storage. Okay, so that application is considered pat client. Where? Why? Because that application use resources from like the device itself and it shared with the with the server.

Speaker 1 02:24:16

Any other application that you can consider as a path client. Okay, so I'll give you another one. So for example, like suppose that we have human resource system. So the system is like related to data for employees, for example. And I need like to generate reports on for like the number of employees I have in my company. The people are on leave or whatever. So that information is on the server. So I can get that information from the server. And then I can generate the reports here on the client. So I can pull that information from the server. For example, like I can filter that information from the server. So the server will send me like the filtered data. And then I can like use the those data too. With the help of like running reports on the client, I can generate those reports on the client machine. Then we can like have something called PAT client.

Speaker 1 02:25:25

Any client is everything on the server. So I can send the request to the server and then the server will like send that information to me. For example, we have like the browser. The browser and any control system is authentic client. We send the request to the server. Where is the host of that from A giving website is. So the server will like send us that information. Just that the client will take that information and rank it, put it in a nice implementation on the screen. So this we can call it the client. So then we have three tiers architecture. So we have a client, application and data. So for example, like if I have like. Like a large application, for example human resources. So the client is there. The application is a server that holds the forms, the reports and everything the business rules. While the data server is the third layer. So the client will communicate with the application.

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Send me a list of all of the information. Please start our own lead. So the application layer will communicate with the data layer, retrieve that information and build the reports here. So the report will be sent ready to the client. In this case we have three tiers architecture. Sometimes we have like four tiers architecture. So we can like create a server here the server would be like in the middle between two layers. So we can create another layer there that it will like help. The communication between will be like a cache. If I have like frequent request of the same data, I can save it in a cache here. And then if like the cache is full or if I couldn't find the new request in that server, I can travel to the original server. So we have like multiple or many configuration or many models that we can use for those applications. So this is like the different tiers that become.

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We discussed for we have details architecture, we have four tiers and so on. So next we want to discuss this like the last part of this lecture, which is architecture Design for UBICOM system and mainly like we'll talk about smart dei. So DEI is short for device, environment and interaction. So in this model we will discuss how devices will be connected to sense some information in like the surround environments and how that interaction action would be created. So u become a system model is a model as you see there. So all of like this short, short sensors are descriptive below. So we have physical environment, we have the human environment, the physical environment, for example, like ecological, living and physical phenomena. That is for example, like we have for example sensors and whatever, those sensors will be connected to this system and those sensors will connect somehow over something called cyber physical interface.

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So there is a physical interface between those sensors and our system. For example, like this is our system where like we have the processor, we have like the application and then we need like the processor, we need like to process the data coming from those sensors to take decisions, filter it provided to the user and so on. So data pulling, pulling up or pulling down from like all of these sensors using something called cyber physical interface cpi. The data is like saved here in this system. This system provides autonomous distributed so we can use distributed system, all right, to provide that information to the user which is related to the human environment. The human environment consists of personal, social and public where we have hci. HCI is short for human computer interaction. So we'd like to design a human computer interaction tool that connect to the system to be able to visualize that data coming from those sensors.

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All right? For example, suppose that we have sensors in this room. For me as a user, I need like to access that information so the sensors will connect to this system. That system will like display that information in a good way for the users to be able to interact with. For example, I want to like decrease the temperature, I want to increase the temperature and so on. I want to like sense the temperature in this room at certain time. So we have like those connections between human environment and physical environment. So as you see, there is like there is no direct connection between physical and the human environment. But that's why like we, we have this system. So this is like your task guys in this course to design this system. All right, so this system could be like communicate with sensors as I mentioned, and then display that information what we are sensing display to the user.

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All right, so the system should be like support context awareness. Saying that I want to like inform the user. There is like kind of sensors are installed in this for example in this environment. So that's why like we have context awareness, autonomous Autonomous it means that I can like those sensors can work without my intention. All right. So if you like walk in a hallway, the light will be turned on automatically. So there is no interaction between to make them run or not. So that's why like we use intelligent means that I can like use intelligent protocols, intelligent concepts to gather or like manage the data coming from those sensors. And of course it will like support distributed system is that multiple users can use that service anywhere, anytime. It has transparency transparency and so on. So as we mentioned like this model called DEI device environments and interaction model.

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And then of course like we use a smart so a smart model it means that we can like means that the entity is active, it has connected to a network. It can operate with like some context of like autonomously like configured and so on. So the architecture design of DI model so we have different types. So we have like to increase the ability to produce low power design through low power components. And we discussed that that in today's lecture how we have like to focus on low power components in those devices that connect to microcontrollers to build systems. We have to increase the capability of embedded devices in the physical environment. How we can like install different devices in the environment that to make like a smart environment without affecting like the power consumption increase the capability of more distributed mobile devices.

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Whenever like that service supports distributed mobility it means that it can like reach to multiple users at the same time. And that give us like lots of lots of flexibility and power for that system. So this is like the smart DI model. So in device environment interface model we have smart devices, smart environments and smart interactions smart devices devices. For example, like we have multitask operating system that connects all of these devices together, make them smart in a way that they can communicate in a good operating system that will like reduce the power consumptions, increase the efficiency and so on. Then we have smart environments. It means that we collect support applications for specific or embedded systems. So we can like to create connect to those sensors and create embedded systems smart interaction in that we like to take the data from those smart devices and then present them in a good way to the users.

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Even like by using multi agents that can like take part of the part of the role between like a single agent or multi agent to use that devices or use data from different sensors and then present it to the client. So the characteristics of smart devices it has should be have mobility dynamic service display. For example, like if I'm like entering a new place, we have like new system service discovery for those applications. Resource access, we have the ability to access those resources. Devices could like have like multifunctional characteristics or features. So all of like this, we can call them smart devices. But the trade off, so here like the trade off of all of these features could be like system needs to be well maintained and hardware component should be like taken or selected carefully. This is like talking about smart environments.

Speaker 1 02:36:48

All right, so here like what this slide, we're talking about smart environments and how smart environments can be consists of network devices that has some connections to the physical world. Smart interaction. Smart interaction is like how we can like build an interface that connects to the system where that system connect to devices where interaction is presented to the user. So we have basic interactions. We have smart interactions. Basic interactions like sequence of messages. For example, like if I connecting to a sensor and that sensor just sending temperature, I'm sending like sensing temperature in this so I can design a system that will extend the temperature every five minutes or every ten minutes. We call that basic interaction. It's like sequence of notifications or sequence of messages between the sensors and the user.

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On the other side we have smart interaction where we can like implement coordinates policies. I can say that don't send me like the messages every second. I need like useful messages. If there is a increase in temperature within the thirteen threshold, send me that increase or decrease. What is the point if like keep sending me the same temperature? Like the current temperature in this room is twenty. So every time like I'm like you, I get like twenty twenty, okay, fine, that's fine. But I need like something else. For example, if the temperature is decreased or increased in a certain, certainly within certain threshold, you can like send me that, send me that temperature. So that's why like we call that smart interactions. We have the coordinate, we have some policies, we have like some convention based dynamic organization and so on.

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So all of like these can be part of dynamic interaction. So this table shows the comparison, comparison of smart devices, smart environment and smart interactions. So I will leave that for you guys to look at it, to look at that comparison. But here like you have to understand what we buy. H to C. H is like short for human. C is computer. So human to computer, C to H computer to be of C to C. Computer to computer. For example, like a smart device, you can find that it's good strong in C to C. It's strong with computer to computer or component to component. Those are smart devices, a smart environment. C two P component to people, C two edge component to human. Sorry this one C to B Is computer to process. C to H, computer to human. So you have to know that convention short for those expressions. So I leave that for you guys to look at it. And lastly, this is alternative device environment, interface, interaction model.

Speaker 1 02:40:14

So this like kind of modified one. In this model we start with smart devices. Then we have interaction, one to one interaction. It means that we have one or peer. Peer to peer, one component, one interface. All right. And then we have one too many, many to many interaction. So we have like one component and then we have many interfaces, faces connected to that many users connected to that information. Then smart mobile devices, smart environment and smart interaction. This is like a modified interaction modeling. So before we leave, guys, any questions about this lecture? What will. What we'll do this week? This week we'll have. On Wednesday we have again like class activities for with the visualization toolkit. I will share with you guys the handbook for that visualization toolkit. It's not important you understand or like you read it all.

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So just so this is like the document documents for that visualization tool. These documents helps you to understand what's going on. I know you are busy, but it's a manual. You don't have to look at it. Okay, it's a manual, all right. In this, it's like it described the installation which we, which we did in the last week. All of the installations and the packets and so on. But we have to understand how to use it. It's not just I'm gonna copy this command and that's it. No, you have to understand what's going on there. So that's why I will. It's. I would like ask you to read this manual if you want. You want to like have more information about it. I will leave the TA to give a small introduction about that visualization tool. For example, how to use the node. We have something called nodes. What the node represents, we have like bridge or network or channel.

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What that channel represents, we have application. What that application represents. So just we have four main major components in that visualization tool. It's recommended. You know what we mean by all these components? We have network, node, application, channel, and I believe like debug. So we have four more components. I will share the documents with you and I would like ask the DA to go over quickly to summarize all of these components and then you will be able to implement the class activities in one state. By the way, do you like this structure? We have have like the theater on Monday and Wednesday. We have practical part perfect. So okay, see you next week, but you have to attend on Wednesday. All right. Thank you so much.