Embedded systems

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the basic components of a computer system, specifically comparing a system board to a chip system. The system board consists of separate components like memory and input/output, while the chip system integrates all components onto a single board. The system board is generally more expensive due to the individual components needed. The chip system, on the other hand, offers advantages in terms of size and configurability. The chip system allows for more versatility and customization, making it suitable for development and experimentation. Additionally, the video introduces important terms like "IC" (integrated circuit) and "VLSI" (very large scale integration), which refer to the size and complexity of electronic components. VLSI technology allows for the creation of millions of transistors on a single chip, providing benefits such as compact size and high functionality.

the evolution of processors from using vacuum tubes to transistors, leading to the development of microprocessors. Microprocessors are made up of control units, registers, and other components, enabling the creation of complex computing systems. The primary processor is the main component in a system, while secondary processors like GPUs and USB controllers support the primary processor. The transcript also discusses the difference between MPU and CPU, emphasizing the importance of microcontrollers for high-performance applications. Additionally, it mentions how applications interact with the kernel and drivers in an operating system. The role of microcontrollers, such as Arduino kits, in enabling interaction with hardware components is highlighted. Overall, the transcript provides insights into the components and functions of different processors and their significance in computing systems.

the differences between CPU, GPU, and DSP, as well as the importance of understanding terms like SCU, AMC, and System on Chip. They emphasize the significance of comprehending these terms for future discussions and explain that they will delve into computer operation and execution in the upcoming content.

- There is three types of memory in embedded systems: RAM, ROM, and cache. RAM (Random Access Memory) is the memory that can be accessed randomly and at the same speed. Android operating system requires RAM for its installation and functioning. The speaker explains that RAM is volatile, meaning that data is lost when power is turned off. ROM (Read-Only Memory) is the non-volatile memory that retains data even when power is off. There are two types of ROM: programmable ROM (P-ROM) and mask ROM. The speaker also mentions that the processor interacts with both RAM and ROM through a chip called a CPU. The speaker then discusses cache memory, which is a small, fast memory that stores frequently used data for quick access. The speaker emphasizes the importance of understanding the different types of memory and their roles in embedded systems.
- embedded systems and their memory types. A company, which is next to the RAM, constantly refreshes its memory, causing the speaker to encounter a major problem. The company, represented by a microcontroller (SBC), and the speaker both access the same memory, resulting in conflicts. The speaker questions the company about the change in value of a specific bit, and the SBC responds by accessing the memory more frequently. This results in data corruption, and the memory issue persists. The speaker emphasizes that it is important to understand the cause of the problem and offers that the benefits of the system outweigh the challenges. The discussion then shifts to other topics related to the system's administration.
- help us remain specific with our requirements. The cost per bit applies to every memory type, regardless of its size. For instance, comparing two memory types with different sizes does not matter since each one has its own size and we are constantly comparing. The third requirement is that the memory should be readable, also known as volatile. Volatile memory can be easily modified, allowing us to use it extensively. The fourth requirement is that the memory should be able to be converted to heat, as it was previously used for heating purposes. The controller, or the RAM from a specific company, is essential for us because it controls the data and prevents unintended access, which is crucial on a CPU. We encountered a problem with the controller being too small, which caused issues for us. If the problem was with the small controller itself, it would be a problem for us as it would interfere with our solution. Instead, we found a problem with the controller's size being insufficient for our needs. We didn't want a small controller; instead, we wanted the second type, known as the static RAM. Static RAM can be used with larger sizes, allowing us to buy larger sizes from it at a reasonable price. Overall, the first type, dynamic RAM, was discussed, followed by the transistor. We have various types of memory around us, such as telephones, which have at least six transistors. Therefore, we have a design that remains with us, including the bit, the transistor, and the memory.
- the concept of transistors and their role in memory types. The speaker explains that there are two types of transistors, one called PMOS and the other NMOS. Each

transistor has a value, and the total number of transistors determines the cost. The speaker then discusses the importance of understanding the cost of transistors from a company's perspective and suggests thinking about the number of transistors required for each component. The speaker also mentions that the cost of transistors is not the only factor to consider, as the number of transistors in a component determines its size and complexity. The speaker then discusses the concept of a memory system and how it is composed of multiple memory cells, each with its own cost and purpose. The speaker concludes by emphasizing the importance of considering the size and complexity of the memory system when making a purchase.

- the difference between various types of memory in embedded systems. While all of us may not have access to a computer's probe, we can still talk about the memory types we have at home. The question remains as to which one between RAM and ROM is larger in size, and the answer depends on the specific type of ROM. If the size of the ROM is larger than the size of the RAM, then it is the one that remains. There is no problem with the explanation as long as it is clear, and we have completed discussing the first type of memory. I hope to complete the explanation of all memory types in the future, and for now, let us move on to see what else is in the exam. There is no problem with any issue in the explanation as long as it is clear during the discussion. The essential thing is the essential thing So, all in all, I want to write something in the margin, but I don't know what to write. I'll leave it for now.
- memory are made up of a certain number of bytes. For instance, a word in a microcontroller like the one being discussed may consist of two bytes, which is equivalent to 16 bits. The speaker acknowledges that there might be some difficulties with this, but assures the audience that they can handle it. He mentions that they have finalized the hard parts, and encourages listeners to try and understand. The speaker also mentions that they have a Telegram group where they can discuss the topic further.
- different types of memory in embedded systems, focusing on RAM and ROM. RAM, or Random Access Memory, is the memory that remains active while the system is running and stores data that the processor can access directly. ROM, or Read-Only Memory, is the memory that contains the code that initializes the system and cannot be modified. The speaker explains that the processor and the operating system perform all the instructions in the ROM. He also mentions that the memory organization of the system determines which parts of the memory remain active and which parts are inactive, making it essential to understand the memory hierarchy. The speaker also touches upon other types of memory, such as Fluid and Control Registers, but the focus remains on RAM and ROM.
- the concept of positive and negative charges in embedded systems, using the analogy of a girl and a balloon. The balloon represents a capacitor, and the girl represents the system. When the balloon is charged positively, it remains connected

to safety, but if a negative charge is applied, the capacitor will discharge and the balloon will burst. Similarly, in a system, there are two types of memory: volatile and non-volatile. Volatile memory, like the balloon, retains its charge as long as it is connected to power, while non-volatile memory, such as flash memory or RAM, can store data without power. The speaker emphasizes the importance of understanding the difference between these types of memory for embedded systems. They also discuss the concept of RAM, which is not the same as the RAM we are familiar with, but rather a type of memory that can be read or written to by the processor. The speaker encourages the audience to pay close attention to the lecture for a better understanding of the various types of memory.

- the difference between embedding code on various types of memory in embedded systems. He mentions that for certain types of memory like RAM, embedding code once is sufficient, but for others like ROM, the code must be burned multiple times for it to function correctly. He also mentions that the user, who is responsible for embedding the code, remains unchanged regardless of the memory type. The speaker then moves on to discuss the second type of memory, ROM or mask ROM, and how it functions differently. He explains that the code on this type of memory cannot be changed once it has been burned, and the user must carefully write the code into the memory's designated areas. The speaker also mentions that the computer or device being used will also utilize the software and firmware present on the ROM, and that the ROM and its contents remain constant and immovable. The speaker concludes by stating that the first type of memory, mask ROM, is used when the manufacturer creates the chip, and they are the ones who download the code onto it. He then invites the audience to explore the second type of memory, ROM or 1K ROM, further.
- the concept of RAM (Random Access Memory) in embedded systems. RAM is a type of memory that the hardware owner, such as a microcontroller or microprocessor, directly controls. The code that is currently running on the system remains in the RAM, and changing the second code does not affect the first one. RAM can be volatile or non-volatile, with volatile RAM requiring constant power to maintain data and non-volatile RAM retaining data even without power. The process of writing and reading data from RAM can be time-consuming, taking up to half an hour for a small amount of data. The Arduino, for instance, has limited RAM capacity, and it is essential to manage it carefully to avoid data corruption. The speaker also mentions the importance of understanding the differences between RAM and other types of memory, such as ROM (Read-Only Memory) and Flash memory.
- different types of memory in embedded systems, specifically focusing on Flash and RAM. Flash memory, one of the types, is important as it stores the operating system and bootloader, allowing the Android system to run. The speaker also explains that the number of times a Flash memory can be written and read is significant, and the

term "Andy OS" refers to this property. Regarding RAM, the speaker notes that it remains constant at 100,000 accesses, and the cost per bit is essential. The speaker also mentions that the size of the bit varies, and as a result, the cost in the bit also differs. Another crucial concept is byte access, meaning that the processor can perform an operation on every location in memory, and the processor can write or read in different memory locations without a noticeable difference. The speaker emphasizes the importance of understanding these concepts in the context of microcontrollers and their memory requirements.

- different types of memory in embedded systems, specifically RAM and ROM. He explains that while large amounts of data can be stored in RAM, it is not ideal for storing small, valuable data like passwords because it can be easily accessed and may require additional security measures. He then mentions various types of ROM, such as Internet and External, which are commonly used in microcontrollers like Arduino or Xbox controllers. He emphasizes that all these components are essential for our interaction with them and can be accessed through communication protocols like COMISSION protocol. The speaker also touches upon the importance of understanding the differences between these components and how they function to effectively interact with external devices.
- the concept of Sector-by-sector in embedded systems, which refers to accessing a specific number of bytes in a sector, ranging from 256 bytes to 16 kilobytes. This method is faster and more cost-effective as it reduces the need for frequent flash memory writes. The speaker also explains that the flash memory interacts with the user-level flash memory without being visible to it, but it triggers changes in the sector's data, which may be stored in specific bytes. The speaker emphasizes that the flash memory's advantages, such as its ability to handle large sizes, make it a valuable component in embedded systems. The speaker clarifies that the difference between flash and RAM is not clear-cut and that both have their uses. The speaker then discusses the concept of erasing all data on a flash memory and writing new data, emphasizing that the flash memory remains faster and more reliable. The speaker concludes by mentioning that the term "the infamous RAM" refers to the fact that RAM requires constant power to function.
- the concept of embedded systems and memory types, specifically RAM and batteries. RAM, which is often small and black, is a type of storage that can be divided into parts. The speaker notes that the RAM chip itself is not very important, but the battery that powers it is essential. The small battery keeps data that is important but not in high demand, while the system prioritizes and loads data from it accordingly. The speaker also mentions that the system returns data from the second RAM to the processor before the first RAM, and the new data does not change the old data in the first RAM. The speaker then discusses the difference between the primary battery and the secondary battery, noting that the primary

battery is connected to the system and the secondary battery stores secrets and takes over when the primary battery fails. The speaker also mentions that the system can continue to charge and extract data from the primary battery even when it is not in use. The battery is essential for the system to function properly.