



Function of Input and Output Technology in Computer Hardware and Software Development

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ABSTRACT

Data processing in a computer system involves a series of important steps carried out by the processor. Data from input devices, such as keyboards or sensors, is received and converted into a format that the digital system can understand. Via the data bus and address bus, data is forwarded to the processor for processing. The processor retrieves instructions from memory, translates them, and executes those instructions. The results are stored back in memory or sent via the data bus to the output device. This data is then routed through the output controller and, if necessary, converted to a format appropriate to the output device. During the output process, data is conveyed to an output device such as a monitor screen or printer, followed by the execution of appropriate actions. This entire process occurs in a matter of time quickly and repeatedly according to the program instructions executed by the computer. A deep understanding of the relationship between input, processing and output is the key to optimizing computer system performance. The processor, as the processing center, plays a crucial role in bridging the connection between hardware and software to create an effective and efficient computing experience.

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1. INTRODUCTION

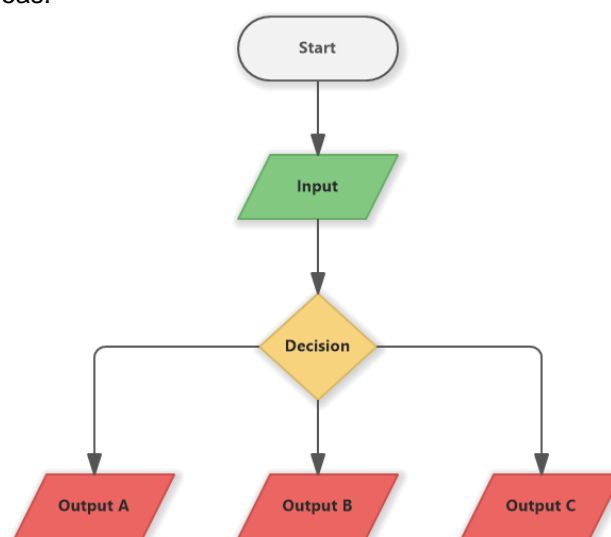
The use of a variety of input devices, from keyboards to complex sensors, enriches user interactions with computer systems. The quality of the input interface plays an important role in increasing user productivity and comfort. On the other hand, the results of data processing must be conveyed clearly through output devices, such as monitors or printers, so that users can understand and respond to the information effectively. According John L. Hennessy dan David A. Patterson “the importance of efficient and scalable computer system design. Concepts such as pipelining, caches, and instruction optimization are integral to their understanding of data processing by processors”.

The data processing center, namely the processor, acts as the brain of the computer system. The processor must not only be able to handle instructions at high speed, but it must also be able to manage input from various devices and direct output to the appropriate devices. Alignment between hardware and software is the key to achieving optimal performance. According to Donald Norman atau Jakob Nielsen “the role of a good user interface in increasing user effectiveness and satisfaction. For them, integration between input, processing and output is key to creating a positive user experience”. In this context, this background discusses the importance of understanding data

processing processes in the context of input and output in hardware and software development. Through this understanding, developers can design computer systems that are responsive, efficient, and capable of providing a superior user experience. By digging deeper into the interactions between users, hardware, and software, we can achieve better evolution in the world of modern computing. According to Andrew S. Tanenbaum “on the way the operating system organizes and manages processing tasks instructed by the processor. They contribute to the understanding of how operating systems play a role in managing input and output”.

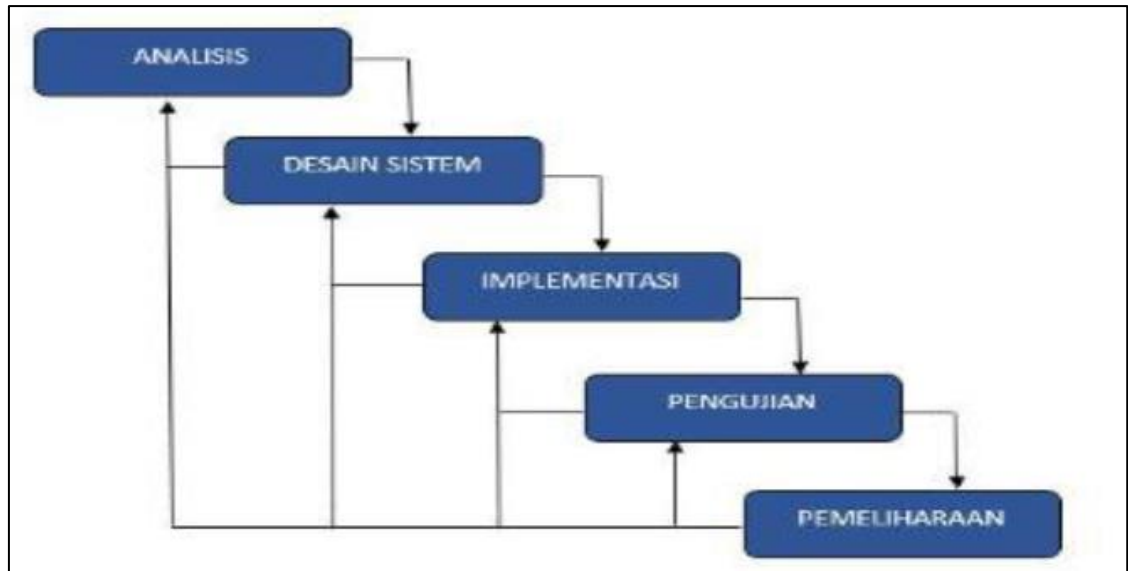
2. RESEARCH METHOD

This research uses a library research method, namely a method of collecting data by understanding and studying theories from various literature related to the research (Adlini et al., 2022). Literature study is all efforts made by researchers to collect information that is relevant to the topic or problem that will be or is being researched (Purwono, 2008). This method is used to detail existing knowledge about a topic, identify or develop a deeper understanding. Data collection is carried out by recording sources and compiling them from various sources such as books, journals and research that has been carried out previously. The library material obtained is analyzed critically and in depth to support the propositions and ideas.



The method used in this research is the waterfall method. The waterfall method is the most commonly used method in making a system, because there are several sequential stages in its manufacture so that if there are steps that have not been completed, you cannot proceed to the next step.

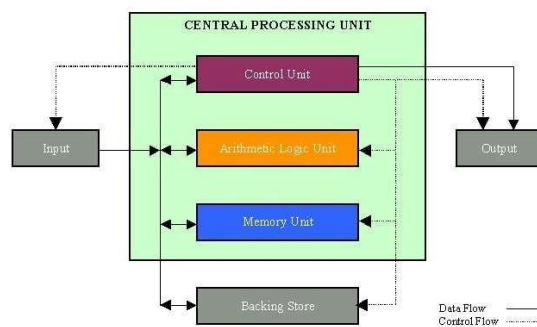
The research framework is basically a framework for the relationship between the concepts that you want to observe or measure through the research that will be carried out. This problem is certainly a concern in all entities contained in it. The sequence of the waterfall method consists of requirements analysis, design, implementation, testing, and maintenance.



Picture 2

3. RESULTS AND DISCUSSIONS

The part of a computer system used to store information and instructions for processing. A storage device is an integral part of computer hardware that functions to store information/data to process the results of computing work. Without a storage device, a computer will not be able to run or even boot. Or in other words, a storage device can be said to be hardware that is used to store, port, or extract data files. It can also store information/data both temporarily and permanently. The way this hardware works is that the first one can be said to be input which is then forwarded to send the next start bit after the previous start, then the data bit will be sent, after that it is sent, then the process is complete. In this case, the CPU has the following workflow:



Data flow in CPU workflow is the process of data traveling through various stages or components in the CPU when executing instructions. During this workflow, data flows through various paths and registers in the CPU. Registers are temporary storage locations used to store data between stages of the CPU workflow. Additionally, control flow also ensures that instructions are executed correctly according to the workflow specified by the CPU hardware. Control flow refers to how the CPU organizes the sequence of instructions to be executed based on the instructions given in the computer program. Control flow is an important aspect of CPU design that ensures that instructions are executed in the correct order and according to the given program logic. Certain CPU architectures can have different control flow characteristics to influence how control flow is controlled.

a. Inputs

This stage is the initial stage of the processing that occurs in the computer system. This stage consists of entering raw data into the computer system via an input device. CPU input comes from the computer including mouse, keyboard, scanner, touchpad and so on.

b. Control Unit (CU)

The Control Unit is one of the main components of the CPU which is responsible for managing and controlling the functions of the entire CPU unit. The main task of the control unit is to regulate the flow of data and instructions in the CPU and ensure that the instructions are executed correctly. The main processes that occur in the controller are as follows:

CU is one of the main components in the CPU which is responsible for managing and controlling the operation of the entire CPU unit. The main task of the CU is to regulate the flow of data and instructions in the CPU and ensure that these instructions are executed correctly. The following are the basic processes that occur in CU:

- **Instruction Fetch**
Fetching the first instruction from main memory or instruction cache. The CU uses a program counter (PC) to retrieve the address of the next instruction to be executed.
- **Instruction Decode (Instruction Decode)**
The CU decodes those instructions to understand what needs to be done. This involves identifying what operations must be performed, the required data sources, and the location where the results are stored.
- **Execute Instructions (Execute)**
The CU coordinates the execution of instructions according to the information found during the decoding stage. This may involve the use of logic circuits and arithmetic and logic units (ALUs) to perform mathematical or logical operations, data movement, and other operations according to instructions.
- **Program Flow Control**
CU is also responsible for controlling the overall flow of the program. This involves executing branching instructions that can change the flow of the program, such as conditional instructions and unconditional instructions. When a branch instruction is executed, the CU decides whether the program flow should jump to another instruction address or continue with the next address.
- **Storage of Results (Write Back)**
After an instruction is executed, the results may need to be stored in an appropriate place, such as a register or a specified memory location. CU organizes the storage of these results.
- **Loops**
The CU will repeat the above steps for each instruction in the program, ensuring that the instructions are executed in the correct order.

c. Arithmetic Logic Unit (ALU)

ALU is one of the main components of the central processor (CPU), which is tasked with carrying out mathematical and logical operations in data processing. The ALU is the part of the CPU execution unit that performs calculations and operations on incoming data.

d. Memory Units

A memory unit is a computer system component used to store and access information and programs required for data and computing operations. It is one of the most important components of computer architecture that allows temporary storage and fast access to information needed by the CPU while using the computer.

e. Backing Store

This stage is a process where the processing results are stored in a storage device and can be reused as input in the next process. Therefore, raw data that has been processed can be stored on storage media, so that it can be reused at any time when you want to print the data.

f. Outputs

Data that has been entered through input equipment is processed by the CPU. This printout can be in the form of hardcopy or softcopy. This copy refers to the use of physical media such as paper or others. Softcopy refers to the display of visual images via a screen or projector. Printing devices include monitors, projectors, printers, etc.

4. CONCLUSION

The role of input-output technology in the development of computer hardware and software is that I/O technology plays a central role in connecting hardware with software, as well as in connecting computers with users and external devices. Without effective I/O technology, computers cannot function properly and will not be able to interact with the outside world. Therefore, a good understanding and application of I/O technology is very important in the development and use of computers and their software. Thus, I/O technology is one of the key components in the computer ecosystem that enables interaction between hardware and software as well as between computers and end users.

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