- ENIAC was programmed by moving wires from one plug to another.
- John von Neumann proposed that both ***programs*** and data be stored in memory. Heretofore only data were stored in memory.
- A stored-program machine architecture satisfies at least the following characteristics:
  - Consists of three hardware systems:
    - A **central processing unit (CPU)** with a control unit, an **arithmetic logic unit (ALU)**, **registers**, and a program counter.
    - A **main memory system**, which holds program that control the computer's operation; and
    - An **I/O system**.
  - Capacity to carry out sequential instruction processing.
  - Contains a single path, either physically or logically, between the main memory system and the control unit of the CPU, forcing alternation of instruction and execution cycles. This single path is often referred to as the **von Neumann bottleneck**.
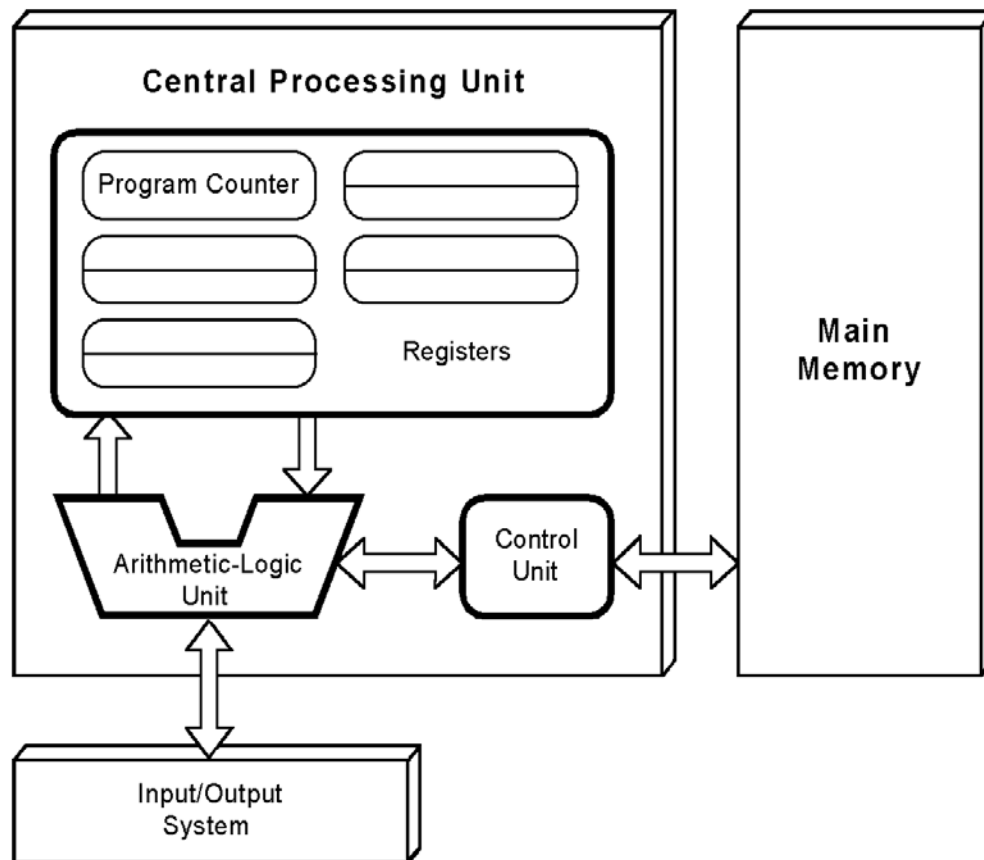
Figure 1.5 The von Neumann Architecture

The von Neumann architecture runs programs employing a f**etch-decode-execute cycle** described below.

1. **Fetch**: The control unit fetches the next program instruction from memory, using the program counter to determine where the instruction is located.
2. **Decode**: The instruction is decoded into specific operations for the ALU to perform.
3. **Execute – fetch operands**: Any data operands required to execute the instruction are fetched from memory and placed in registers in the CPU.
4. **Execute – operation**: The ALU executes the instruction and places results in registers or memory.
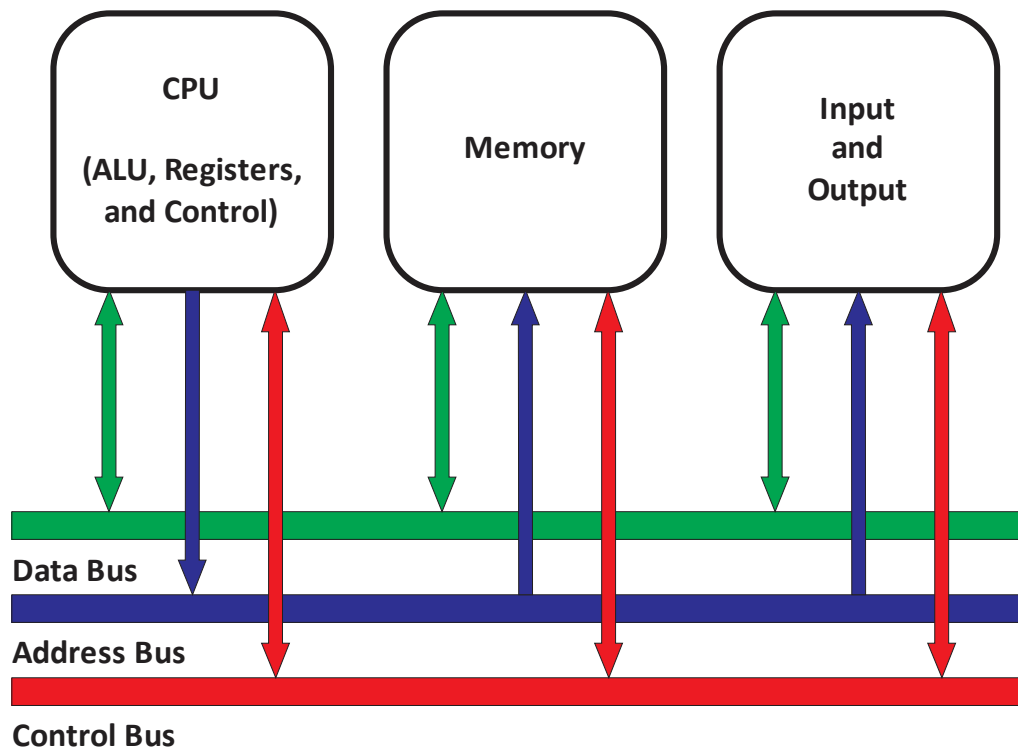
Figure 1.6 The Modified von Neumann Architecture, Adding a System Bus