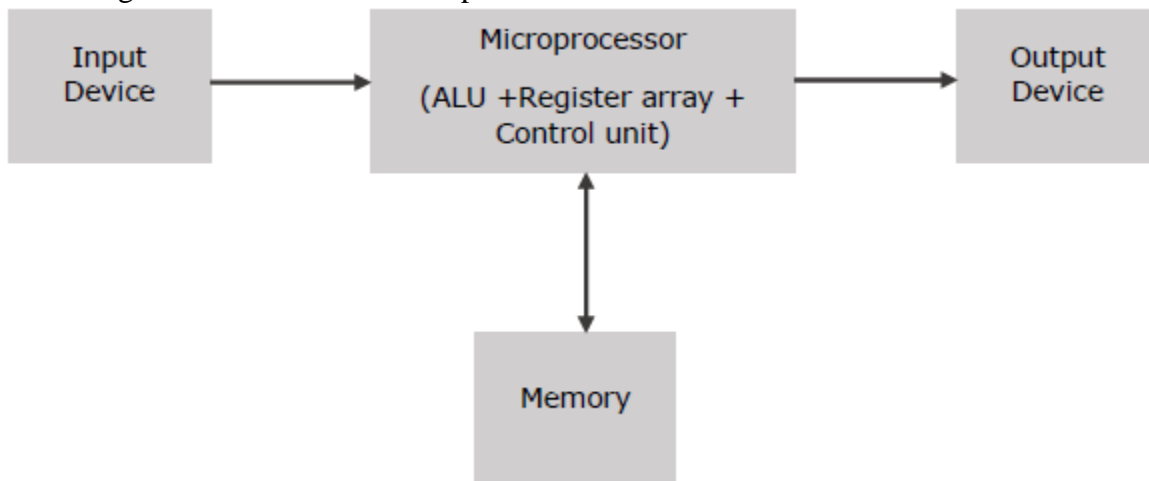


Microprocessor?

Microprocessor is a controlling unit of a micro-computer, fabricated on a small chip capable of performing ALU (Arithmetic Logical Unit) operations and communicating with the other devices connected to it.

Microprocessor consists of an ALU, register array, and a control unit. ALU performs arithmetical and logical operations on the data received from the memory or an input device. Register array consists of registers identified by letters like B, C, D, E, H, L and accumulator. The control unit controls the flow of data and instructions within the computer.

Block Diagram of a Basic Microcomputer



How does a Microprocessor Work?

The microprocessor follows a sequence: Fetch, Decode, and then Execute.

Initially, the instructions are stored in the memory in a sequential order. The microprocessor fetches those instructions from the memory, then decodes it and executes those instructions till STOP instruction is reached. Later, it sends the result in binary to the output port. Between these processes, the register stores the temporarily data and ALU performs the computing functions.

List of Terms Used in a Microprocessor

Here is a list of some of the frequently used terms in a microprocessor –

- **Instruction Set** – It is the set of instructions that the microprocessor can understand.
- **Bandwidth** – It is the number of bits processed in a single instruction.
- **Clock Speed** – It determines the number of operations per second the processor can perform. It is expressed in megahertz (MHz) or gigahertz (GHz). It is also known as Clock Rate.
- **Word Length** – It depends upon the width of internal data bus, registers, ALU, etc. An 8-bit microprocessor can process 8-bit data at a time. The word length ranges from 4 bits to 64 bits depending upon the type of the microcomputer.

- **Data Types** – The microprocessor has multiple data type formats like binary, BCD, ASCII, signed and unsigned numbers.

Features of a Microprocessor

Here is a list of some of the most prominent features of any microprocessor –

- **Cost-effective** – The microprocessor chips are available at low prices and results its low cost.
- **Size** – The microprocessor is of small size chip, hence is portable.
- **Low Power Consumption** – Microprocessors are manufactured by using metaloxide semiconductor technology, which has low power consumption.
- **Versatility** – The microprocessors are versatile as we can use the same chip in a number of applications by configuring the software program.
- **Reliability** – The failure rate of an IC in microprocessors is very low, hence it is reliable.

What is a Vacuum Tube?

The vacuum tube is a device that was developed by English physicist John Ambrose Fleming for the first time in 1904, which contains electrodes to control electron flow. Generally, in a sealed container, it is used to control flow with the help of a vacuum. In early computers, it was also used as a switch or an amplifier, and it is also known as a valve or an electron tube. The below picture shows a different kind of vacuum tubes.



During the first half of the 1900s, it was used in televisions, sound recording, industrial automation reproduction, radar equipment, radios, and telephone network systems and is the predecessor of the modern transistor that means, as transistors may be used today, the vacuum tube was used in creative ways as electronically controlled rectifiers, oscillators, switches, and amplifiers.

In older computer monitors and televisions, the CRT (cathode ray tube) was widely used as a screen is a kind of vacuum tube. First, it was invented as a basic component for electronic devices and most commonly used in the evolution of analog as well as digital computers in the first half of the twentieth century.

The vacuum tube produces electrons and an anode as it was made of a cathode, and the anode collects the electrons called a diode. However, there were other kinds of vacuum tubes available, which were categorized on the basis of the number of electrodes presented. Then, these electrodes are surrounded typically in glass, in a casing; when energized enough, it can act as a conductor with all the air detached. As lightning travels through the air, in the same way, a pathway becomes for electrons. Therefore, it is commonly known as the vacuum tube due to the shape of the vacuum.

Also, the vacuum tube produced a lot of heat as it needed massive amounts of power; because it required a heating filament for producing electrons. Due to a lot of heat, the components were quickly degraded; therefore, they burned out quickly. In order to work, three different power sources are also required by vacuum tubes, which are based on capacities and ratings. The power consumption and size became smaller with the progress of vacuum tube technology. Also, they were cost-effective, and transistors work effectively only for low frequencies. With the transistors in a cascade, a hundred transistors in parallel and wired together will be required for high frequencies. That led to the need for heat sinks, which creates massive heat.

An equivalent transmitter needs significantly less power and only uses a single tube. Also, it can be coded with the help of forced air or water cooling. The speaker damping effect of vacuum tubes and solid-state amplifiers cannot repeat the peculiar distortion; hence, in sound amplifiers, the vacuum tubes are more common. The vacuum tube started to replace by the transistor in the 1950s. Due to the size of the transistors, they were become much ideal to use as the size of computing devices started to become smaller. In smaller computing devices, vacuum tubes did not fit as they were large in size, which led to becoming less useful.

Additionally, today vacuum tubes are still used in high-end audio equipment and big radio stations, especially those using frequencies more than 50 MHz and energy levels more than 10,000 W; hence, the vacuum tube technology is not completely obsolete.

What is Sensor Evaluation technology?

Sensor technology has advanced exponentially in the past few decades. In this trend, the discovery and development of electroactive polymers can be considered a breaking point in this field. Also, the combination of materials with the development of nanotechnology was able to produce miniaturized devices with superior sensing properties. This chapter is presented in the following order: first, an introductory section seeks to explain the basic vocabulary and the essential concepts for organic-based sensors. After, the main phenomena that involve the use of organic polymers in sensors, especially chemical sensors, are presented. The third part highlights the main characteristics of conducting polymers associated with technological development in chemistry, physics, and engineering and how it enabled many sensors. Next, in the fourth part, examples of organic polymer applications through relevant literature reports are presented. Finally, some challenges from human society are highlighted where sensor and biosensor technology new developments are essential.

Sensing Materials: Metals Oxides

Chemical sensors

Sensor technology is both fundamental and applied device-based technology pertaining to various interdisciplinary fields (Dakshayini et al., 2019). More specifically, a sensor is a device that converts an input signal from a stimulus into a readable output signal (Gründler, 2007), where the

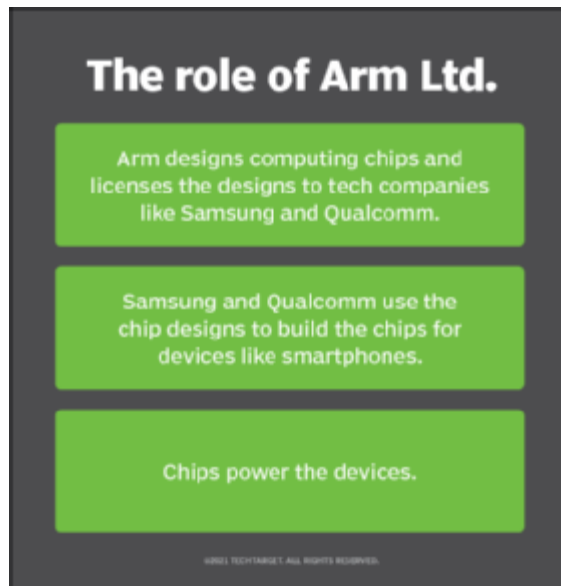
input signal can be any measurable characteristic such as quantity or physical variation, while the output is ultimately an electrical signal (Askim et al., 2013). Chemical sensors have received a lot of attention because they are devices that allow data collection and obtaining information generally with minimal manipulation of the studied system, so that the results obtained can be analyzed and correlated with other parameters in the environment in which they are inserted (Lowinsohn and Bertotti, 2006). These devices have peculiar characteristics that distinguish them from large instrumental methods, which, in turn, are increasingly accurate, sensitive and selective. In addition, other advantageous features inherent to

What is an Arm processor?

An Arm processor is one of a family of central processing units (**CPUs**) based on the reduced instruction set computer (**RISC**) architecture for computer processors. Arm Limited, the company behind the Arm processor, designs the core CPU components and licenses the **intellectual property** to partner organizations, which then build Arm-based chips according to their own requirements. Arm Limited does not manufacture or sell any chips directly.

Acorn Computers first developed the Arm processor in the 1980s. Until recently, the name *Arm* was treated as an acronym, *ARM*, which at first stood for *Acorn RISC Machine* and then for *Advanced RISC Machine*. The acronym is still widely used, although Arm Limited uses only *Arm* when describing its processor technology.

Arm Limited offers designs for both 32-bit and 64-bit RISC **multicore processors**. The processors use a much simpler **instruction set** than their Intel counterparts, which are based on the complex instruction set computing (**CISC**) architecture. The two types of processors also employ different methods to optimize performance and increase efficiency. For example, Intel takes a hardware approach to maximizing performance, whereas Arm takes a software approach.



Arm processors can execute many more **millions of instructions per second** than Intel processors. By stripping out unneeded instructions and optimizing pathways, an Arm processor can deliver outstanding performance while using much less energy than a CISC-based processor. The reduction in power also means that Arm CPUs generate less heat. That's not to say Arm processors are inherently better than Intel processors, only that they're better suited to specific use cases.

Arm processors are used extensively in consumer electronic devices such as smartphones, tablets, wearables and other mobile devices. They're also used in a wide range of sensors and **internet of things devices**. According to Arm Limited, the company's partners have shipped more than 215 billion Arm-based chips over the past three decades.

What are Arm processor features?

Because of their reduced instruction set, Arm processors require fewer **transistors**, resulting in a smaller die size for the **integrated circuitry**. Their smaller size, reduced complexity and lower power consumption make them suitable for increasingly miniaturized devices.

Arm processor features include the following:

- load/store architecture
- integrated security

- orthogonal instruction set
- single-cycle execution
- energy efficiency
- 64- and 32-bit execution states
- **hardware virtualization** support

The simplified design of Arm processors offers more efficient multicore processing and easier coding for developers. While they don't offer the same raw compute throughput as Intel CPUs, Arm processors sometimes exceed the performance of Intel processors for applications that exist on both architectures.