Microprocessors and Microcontrollers

This report shall discuss the following topics:

• Topic 1: Microprocessors

• Topic 2: Microcontrollers

• Topic 3: Microprocessors vs Microcontrollers

1) Topic 1: Microprocessors

- Working of a Microprocessor
    - A microprocessor works on the fetch-decode-execute-store cycle.
    - This cycle breaks down complex input to tiny steps that run with the system clock.
    - The first step is fetching instructions from the system memory after a read signal given by a control unit.
    - The next process is decoding what instructions are contained in the binary code, converts it into machine code and further converts it into specific control signals telling the system what to do.
    - The given control signals are then run by the microprocessor which runs them to get an output.
    - The output is then stored back into system memory.
- Architecture and Components of a Microprocessor
    - Every microprocessor contains at least three core components. ALUs, Registers and Buses.
    - The ALU performs mathematical and logical processes along with bit shifting.
    - Registers store instructions and data for the ALU to process, they're just small memory storage units.
    - Buses are used to transfer data between any two components. Bigger the bus, faster the transfer speeds.
- Commonly used Microprocessors
    - ARM and x86

2) Topic 2: Microcontrollers

- Working of a Microcontroller
    - It too runs on the fetch-decode-execute-store cycle. It uses the same working principles as a microprocessor.

- Architecture and Components of a Microcontroller
  - Architecturally, it's different from a microprocessor because it integrates the ALU and memory into the same circuit.
  - This makes it less programmable, lower power, more efficient and have lower memory.
- Commonly used Microcontrollers
  - Arduinos, ESP32, ATtiny85 or a Raspberry Pi Pico.

3) Topic 3: Microprocessors vs Microcontrollers

- Microprocessors are versatile, higher cost, more powerful usually and require more robust setups. They can perform multiple different tasks at once.
- Microcontrollers don't need external circuits as everything is integrated into one circuit including I/O ports.
- This is why microcontrollers excel at reading sensors and controlling actuators with predictable timing. This makes them ideal for appliances like microwaves or washing machines.