1.1 DRONE CONCEPT:

INTRODUCTION:

- An unmanned aerial vehicle (UAV) or uncrewed aerial vehicle commonly known as a drone, is an aircraft without any human pilot, crew or passengers on board.

- UAVs are a component of an unmanned aircraft system (UAS), which include additionally a ground-based controller and a system of communications with the UAV.

- The flight of UAVs may operate under remote control by a human operator, as remotely-piloted aircraft (RPA), or with various degrees of autonomy, such as autopilot assistance, up to fully autonomous aircraft that have no provision for human intervention.

- UAVs were originally developed through the twentieth century for military missions

- As control technologies improved and costs fall, their use in the twenty-first century is rapidly finding many more applications including aerial photography, product deliveries, agriculture, policing and surveillance, infrastructure inspections.

PARTS OF A DRONE

KEY PARTS

- From an engineer's view, the key parts of a drone system are the hardware, software, and mechanical elements;

- and a perfect balance between the three provides a flawless system design.

HARDWARE

- Hardware is the electrical part of the drone system, which is eventually a PCBA (printed circuit board assembly).

- Hardware is a multilayer PCB that accommodates the SOC (system on a chip) and different

- components of the subsystems interconnected through copper traces (part of the PCB) or physical wires. Figure shows the PCBA assembled with SOC and subsystems on the top side (primary side).
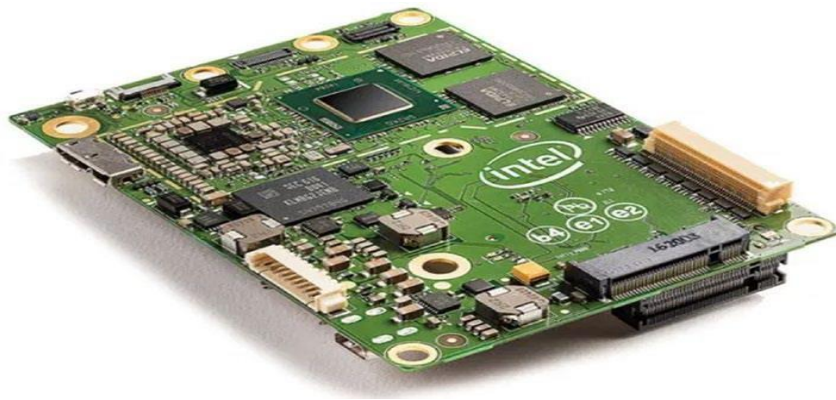
THE SOC (System on a chip)

- The SOC is a miniature computer on a chip of a present generation systems, especially a drone system. It's a semiconductor device and an integrated circuit that usually integrates digital, analog, mixed signal, and radio frequency devices on a single chip. SOCs are most commonly used in mobile computing and embedded systems.

- In general, there are three distinguishable types of SOCs: SOCs built around a microcontroller, SOCs built around a microprocessor, and specialized SOCs designed for specific applications that do not fit into the above two categories. SOC usually consume less power and have a lower cost than the multichip systems they replace.
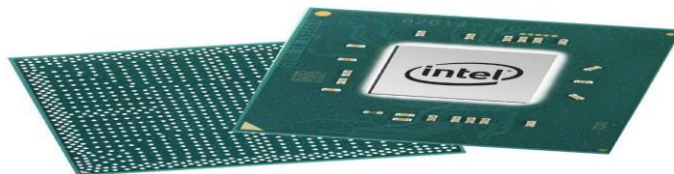
- Figure shows a typical SOC that integrate digital, analog, and mixed signal devices on a single chip. The device at the center of the SOC is the silicon, and some capacitors are

distributed on the top side of the SOC. The bottom side of the SOC shows pins (called as balls in a ball grid array), which are soldered on to a PCB to establish the connection with the subsystems through PCB traces.

- **Subsystems**

  o Subsystems or electrical subsystems are technologies required in a system to fulfill the intended usage of the system. Broadly speaking, subsystems fall into any one of the following computer architecture parts: input, output, storage, and communication devices.

- **Input**

  o A touch panel, keyboard, mouse, microphone, camera, sensors, and remote control are some examples of input devices of a system.

- **Output**

  o Displays, speakers, motors, fans, and LEDs are some examples of output devices of a system.

- **Storage**

  o Memory, flash, hard disk drive, optical drive, secure digital, and solid-state drive are some examples of the storage devices of a system.

- **Communication Devices**

  o Wired LAN (local area network), wireless LAN, mobile networks (3G, 4G, and LTE), GPS (Global Positioning System), and USB are some examples of the communication devices of a system. All of the subsystems listed above may or may not be a part of a particular drone design. The target application picks the right subsystems to be part of the drone system design.

  o For example, if the intended application of a drone is surveillance, it should be equipped with a high-resolution camera and the SOC used in the system should be capable of accepting and processing the high-speed data from that camera. The PCBA should be designed in such a way as to interconnect the high-speed data between SOC and the camera module and then be capable of transmitting the live or recorded data via the wireless communication modules.

- o Besides SOC, the camera module, wireless module (WiFi/3G/4G modules), memory, internal storage, sensors, and flight controllers are the basic required subsystems for a surveillance drone.

SOFTWARE

- • There are four categories of software that need to use on the drone system:

- • *Firmware components*
- • *OS and drivers*

- • *Sensing, navigation, and control*

- • *Application-specific components*