CC101S1

Building Blocks of Internet of Things


Question everything!
Why?
SCHOOL

What is IoT?

- Connected Devices
  - Everyday objects equipped with sensors, processors, and communication capabilities
- Data Exchange
  - Devices collect data, transmit it through networks, and interact with other devices

Key Components of an IoT System

- Sensors
  - Collect data about the environment or physical objects
- Actuators
  - Respond to data received by sensors, taking actions to control devices
- Network Connectivity
  - Enables data transfer between devices and the cloud
- Data Analytics
  - Processing and interpreting data to generate insights and automate actions

Benefits of IoT Technology

- Enhanced Efficiency
  - Optimizing processes and reducing waste
- Improved Decision Making
  - Data-driven insights for better informed choices
- Increased Productivity
  - Automating tasks and optimizing resource allocation
- Personalized Experiences
  - Tailoring services and experiences to individual needs

IoT Applications Across Industries

Smart Homes

Automated lighting, temperature control, security systems

Smart Cities

Traffic management, waste optimization, environmental monitoring

Industrial Automation

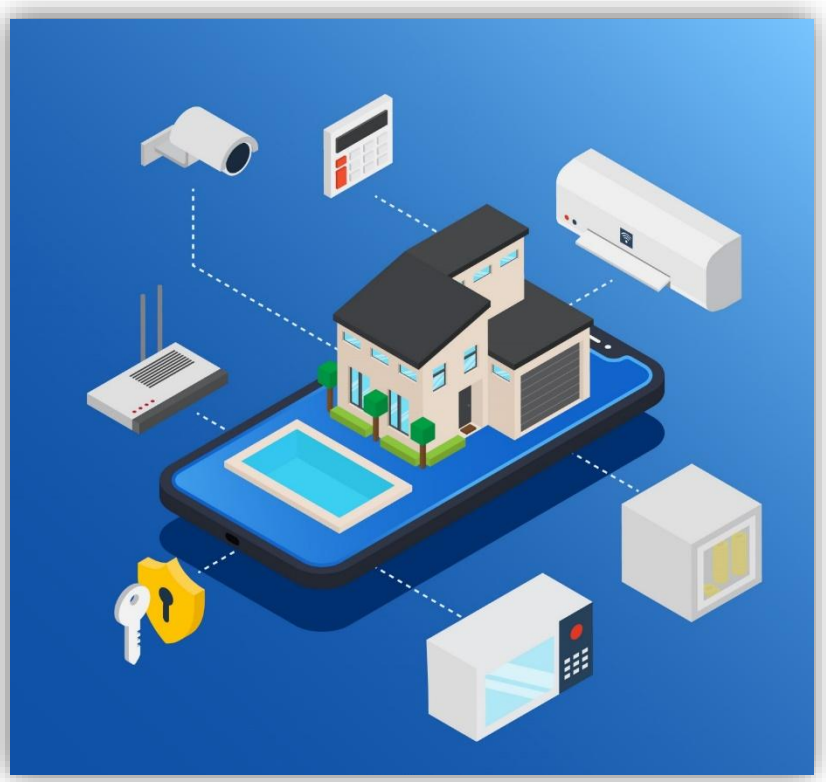
Predictive maintenance, optimized production processes, remote control

Connected Healthcare

Remote patient monitoring, wearable health trackers, personalized treatments

Smart Environments

- **Smart Home:** Emphasizes personalized experiences and convenience for individual residents.
- It includes features such as smart lighting, temperature control, security systems, entertainment systems, and automated appliances.



Smart Environments

- **Smart Office:** Focuses on enhancing productivity, efficiency, and collaboration among employees.
- It features smart lighting and climate control, occupancy sensors, room booking systems, digital signage, and workspace management platforms..

Smart Environments

- **Smart City:** Aims to improve the quality of life for citizens by optimizing urban infrastructure and services.
- This includes intelligent transportation systems, smart energy grids, waste management systems, public safety solutions, smart governance platforms, and citizen engagement applications.

Smart Environments

- **Smart Farm:** Aims to increase agricultural productivity, sustainability, and resilience while minimizing resource inputs and environmental impacts.
- Implements IoT sensors to monitor soil moisture levels, temperature, humidity, and crop health.
- Automation technologies control irrigation systems, greenhouse climate, and feeding schedules for livestock.

Challenges and Considerations

1 **Security and Privacy**

Protecting sensitive data and ensuring secure communication

2 **Interoperability**

Ensuring compatibility between different devices and platforms

3 **Cost and Complexity**

Managing the cost of implementation and integration

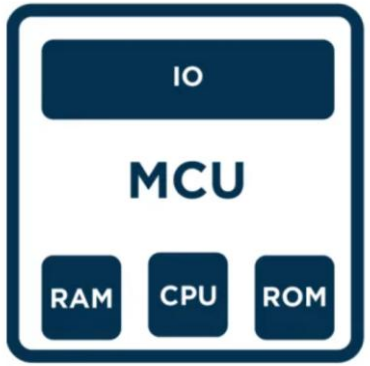
4 **Data Management**

Storing, processing, and analyzing large volumes of data

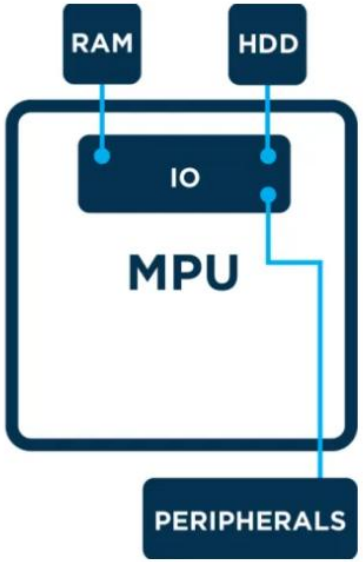
“Brains” of IoT Devices

- In the context of the Internet of Things (IoT) and smart objects, computational ability is often driven by devices called microcontrollers, or MCUs.
- Microcontrollers are tiny, self-contained computers hosted on a microchip.
- Microcontrollers are designed to perform specific functions, and they can be integrated into almost anything ranging from industrial equipment, warehouse inventory items, wearables devices, to home appliances and much more.

MCU Vs MPU



- MCUs (Microcontroller Units or Microcontrollers) are compact, integrated circuits designed for embedded systems with low power consumption and cost efficiency. They contain a processor core, memory, and peripherals, making them suitable for IoT devices and other embedded applications.



- MPUs (Microprocessor Units or Microprocessors) are more powerful general-purpose processors used in computing devices like PCs, servers, and smartphones. They offer higher performance and multitasking capabilities but typically require external peripherals for interfacing with sensors and other devices.

MCU for IoT

- Determining the "best" MCU for an IoT application depends on various factors including the specific requirements of the application, such as power consumption, processing power, memory, connectivity options, and cost considerations.

- However, some popular choices among MCU families for IoT applications include: Arduino-compatible MCUs, ESP32, STM32, NXP Kinetis, etc.

Development Boards

- Development boards, also known as prototyping boards, are hardware platforms designed to facilitate the development, testing, and prototyping of electronic projects and embedded systems.
- These boards typically feature a microcontroller unit (MCU) or a microprocessor, along with various input/output (I/O) ports, peripherals, and onboard components.
- Popular examples of development boards include Arduino, Raspberry Pi, ESP32, STM32 Discovery boards, and many others.

Arduino Uno

Arduino Leonardo

Arduino Due

Arduino Yún

Arduino Tre

Arduino Micro

Arduino Robot

Arduino Esplora

Arduino Mega ADK

Arduino Ethernet

Arduino Mega 2560

Arduino Mini

LilyPad Arduino USB

LilyPad Arduino Simple

LilyPad Arduino SimpleSnap

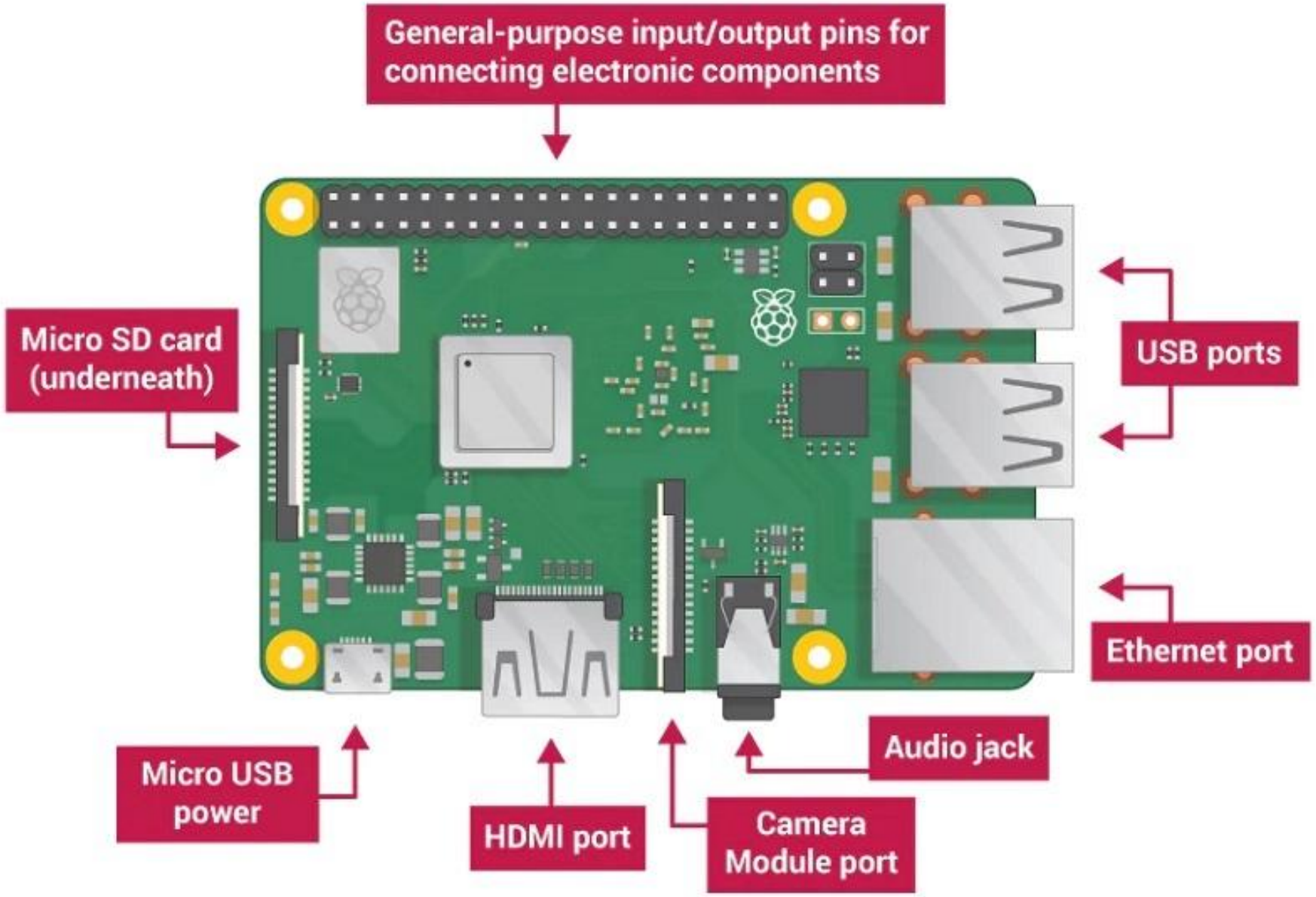
LilyPad Arduino

Arduino Nano

Arduino Pro Mini

Raspberry Pi:

Single-Board Computers (SBCs)



The Future of the IoT

100B

Devices

More interconnected devices and applications

$1.1T

Market Size

Global market expected to reach $1.1 trillion by 2026

10X

Growth

Exponential growth in data volume and complexity

AI

Integration

Greater integration with artificial intelligence and machine learning

Smart:
Up to what?