

Ministry of Higher Education and Scientific Research
University of Anbar
College of Computer Science
and Information Technology
Computer Science department



Internet of Things (IoT)

Lecture One

Assist. Prof. Dr. Ahmed Subhi Abdalkafor

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1. INTRODUCTION

Internet of Things (IoT): is a world of interconnected things which are capable of sensing, actuating and communicating among themselves and with the environment (i.e., smart things or smart objects) while providing the ability to share information by triggering processes and creating services with or without direct human intervention.

With technological advancement, we are using information systems in new ways at work and in daily life. Devices and technologies have become smaller, more powerful, and more widespread.

Technology is no longer limited to offices or computers; it has become an essential part of our everyday lives. It includes not only devices like computers and smartphones but is also embedded in objects and environments around us.

For example, smart devices such as smartwatches and internet-connected home appliances are now widely used.

A smart refrigerator can track food quantities and send notifications to a phone when it's time to restock, and smart lighting systems can adjust automatically based on the presence of people in a room, making daily life easier and more efficient.

Main Concepts of the Internet of Things (IoT)

1. **Connectivity:** Central to IoT is the ability of devices to connect to each other and to the internet. This connectivity allows for the seamless exchange of data between devices and enables them to function as part of a larger system.
2. **Sensors and Actuators:** IoT devices are equipped with sensors to gather data from their surroundings. These sensors can measure various parameters like temperature, humidity, light, motion, and more. Actuators, on the other hand, allow devices to perform actions based on the data they receive.
3. **Data Collection and Analysis:** IoT devices generate vast amounts of data through their sensors. This data is collected, processed, and analyzed to extract meaningful insights. Data analytics, machine learning, and artificial

intelligence play crucial roles in understanding the information gathered by IoT devices.

4. **Communication Protocols:** Devices in an IoT system communicate using specific protocols. Common IoT communication protocols include MQTT (Message Queuing Telemetry Transport), CoAP (Constrained Application Protocol), and HTTP (Hypertext Transfer Protocol).
5. **Cloud Computing and Edge Computing:** IoT devices often leverage cloud computing for data storage, processing, and analysis. Edge computing, on the other hand, involves processing data closer to the source of generation, reducing latency and improving real-time decision-making.
6. **Security:** Security is a critical aspect of IoT due to the sensitivity of the data being transmitted. Measures such as encryption, authentication, and secure communication protocols are implemented to protect IoT systems from unauthorized access and cyber threats.
7. **Interoperability:** Interoperability ensures that devices from different manufacturers and with different functionalities can work together seamlessly. Standardization of communication protocols and data formats is crucial to achieving interoperability in IoT.
8. **Applications:** IoT finds applications in various domains, including smart homes, healthcare, agriculture, industrial automation, smart cities, and more. Examples include smart thermostats, wearable fitness trackers, automated manufacturing processes, and intelligent transportation systems.
9. **Scalability:** IoT systems are designed to scale efficiently, accommodating a growing number of devices and managing increased data volumes. This scalability is essential as the number of connected devices continues to rise.
10. **Energy Efficiency:** Many IoT devices operate on battery power or in resource-constrained environments. Therefore, optimizing energy efficiency is crucial for ensuring the longevity and effectiveness of IoT deployments.

Reasons for using The Internet of Things (IoT)

1. **Data-driven Decision Making:** IoT provides real-time data from connected devices, enabling businesses to make informed decisions based on accurate and up-to-date information. This data-driven approach enhances efficiency and strategic planning.
2. **Operational Efficiency:** Automation and remote monitoring offered by IoT technologies contribute to operational efficiency. Processes can be optimized, and resources can be managed more effectively, leading to cost savings and improved productivity.
3. **Cost Reduction and Resource Optimization:** Through predictive maintenance and optimized resource usage, IoT helps reduce operational costs. Organizations can identify inefficiencies, streamline workflows, and achieve cost savings in areas such as energy consumption and maintenance.
4. **Reducing human error:** By automating data collection and operational processes, IoT reduces the risk of human error resulting in more accurate results, better reliability, better decision making, and improved operational efficiency which helps reduce costs, improve productivity, and ensure compliance with industry standards.
5. **Safety and Security:** IoT plays a crucial role in enhancing safety and security across various domains. Through surveillance, monitoring, and alert systems, IoT helps detect and respond to potential threats, ensuring a safer environment for individuals and assets.