SNS COLLEGE OF ENGINEERING

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING-IOT Including CS&BCT

COURSE NAME : 19SB602 FULL STACK DEVELOPMENT FOR NEXT GENERATION IOT

III YEAR / VI SEMESTER

Unit V- **NG-IoT-Next Generation Internet of Things**

Topic : Evolution of Internet of Things (IoT)

The Internet of Things (IoT) emerged in the 1990s as a concept focused on connecting physical devices to the internet.

Early technologies included RFID tags, barcodes, and basic sensor networks, which enabled simple data tracking and communication.

However, these systems were limited by low connectivity, reliance on manual data collection, and the lack of real-time control or automation.

Internet infrastructure was still developing, making widespread IoT adoption difficult.

A notable example during this period was in smart farming, where farmers used RFID tags for livestock tracking.

Despite this advancement, most farm data—such as input and output records—had to be logged manually.

These early efforts laid the groundwork for future innovations in IoT, paving the way for smarter, automated systems.

EVOLUTION OF IOT - PAST

Emergence of IoT in the 1990s

- The Internet of Things (IoT) emerged in the 1990s as a concept aimed at connecting physical devices to the internet for better data tracking and communication.
- It was the foundation for transforming traditional industries by integrating technology into everyday physical objects.
- Early IoT technologies focused primarily on enabling devices to communicate data across networks, which was a revolutionary idea at the time.

Early IoT Technologies

- **RFID Tags:** Radio Frequency Identification (RFID) tags were used to track the movement and status of objects. They were commonly used for inventory and asset management.
- **Barcodes:** Barcodes were employed for automated item identification, especially in retail and logistics, making it easier to manage and trace items.
- **Sensor Networks:** Basic sensor networks were deployed for data collection. However, these were often limited in functionality and did not provide the real-time data or automation that we expect from modern IoT systems.

Limitations of Early IoT Systems

- **Limited Connectivity:** Early IoT systems were hindered by low connectivity, slow internet speeds, and unreliable network infrastructures, which limited their ability to operate efficiently on a large scale.
- **Manual Data Collection:** Many systems required manual intervention for data logging, making them less efficient and more prone to human error.
- **Lack of Automation:** Early systems lacked the ability to automatically process data or trigger actions based on real-time inputs, leading to less impactful use cases in automation and decision-making.

Early IoT in Smart Farming

- A notable application of early IoT technologies was in smart farming, where RFID tags were used to track livestock and monitor animal health.
- While RFID tags allowed farmers to track the movement of animals, the actual process of recording farm data such as crop yields, livestock health, and resource consumption still required manual input and was often prone to inaccuracies.
- Limited Automation: These systems provided basic data tracking but lacked the automation and real-time analytics necessary for more effective farming.

Legacy of Early IoT Developments

- Despite their limitations, early IoT efforts laid the groundwork for the future development of smarter and more automated systems.
- As technology progressed, IoT solutions began to evolve with enhanced connectivity, advanced sensors, and the integration of machine learning, enabling more sophisticated and scalable applications.
- The legacy of early IoT in industries like agriculture demonstrated the potential for digital transformation, setting the stage for the IoT innovations we see today, from smart homes to industrial automation.

EVOLUTION OF IOT - PRESENT

Evolution of IoT with Advanced Technologies

- The evolution of IoT is fueled by the integration of cloud computing, edge computing, 5G connectivity, AI/ML, smart sensors, wireless networks, and mobile applications.
- These technologies have enhanced the capabilities of IoT systems, enabling:
  - Real-time data monitoring.
  - Remote control.
  - Automation.
  - Intelligent decision support.

IoT in Smart Farming

- In agriculture, IoT is revolutionizing traditional practices by providing advanced tools for monitoring and management.
- Technologies like soil moisture sensors, temperature sensors, and drones are central to smart farming.
- These IoT systems help farmers make data-driven decisions for better resource management and increased productivity.

Soil Moisture and Temperature Sensors

- Soil moisture sensors help farmers monitor the moisture levels in the soil to optimize irrigation, preventing water wastage.
- Temperature sensors track environmental conditions, ensuring the right climate for crop growth.
- These sensors enable precision farming by providing real-time data to improve crop health and yield.

Automated Irrigation Systems

- Automated irrigation systems are designed to optimize water usage by automatically adjusting water flow based on real-time environmental data.
- These systems use data from sensors to trigger irrigation only when needed, significantly reducing water waste.
- This innovation contributes to both sustainability and cost savings for farmers.

Impact on Farming Efficiency and Crop Yields

IoT technologies in smart farming lead to:

- Increased efficiency: Streamlining operations with automated systems and real-time monitoring.
- Reduced costs: Optimizing resource usage (water, energy, fertilizers).
- Improved crop yields: Enhancing productivity with precise environmental control and data-driven insights.

These advancements demonstrate the transformative power of IoT in agriculture, making farming smarter, more sustainable, and profitable.

EVOLUTION OF IOT - FUTURE

Emerging Technologies in IoT for Agriculture

- AI-driven decision-making, blockchain, and NG-IoT technologies are shaping the future of farming.
- Key technologies enabling smarter, connected farming systems include:
  - AI for intelligent decision-making.
  - Blockchain for secure data sharing.
  - 5G, edge computing, and LPWAN for enhanced connectivity.
- These innovations are making farming smarter, more efficient, and data-driven.

Role of Digital Twins and Analytics

- Digital twins create virtual replicas of farming environments, enabling simulation and optimization.
- Analytics help process data from sensors, drones, and machines to gain insights into farming practices.
- These tools are used for predictive farming, forecasting crop yields, weather patterns, and pest threats.

Predictive Farming and Self-Optimizing Farms

- Predictive farming: AI models predict yield, weather, and pest control, allowing farmers to plan better.
- Self-optimizing farms: Using IoT systems to automatically adjust processes like irrigation, planting, and harvesting based on real-time data.
- These systems provide full transparency from seed to shelf, improving sustainability and efficiency.

Drones and Robots in Agriculture

- Drones are used for planting, watering, and monitoring crop health.
- Robots assist in harvesting, weeding, and maintaining fields, reducing the need for manual labor.
- These technologies enable more precise and efficient farming, contributing to increased productivity and cost savings.

Blockchain and AI in Agri-Supply Chain and Decision-Making

- Blockchain secures data and ensures traceability in the agri-supply chain, increasing transparency.
- AI models predict crop yields and detect pest threats early, helping farmers make timely, data-driven decisions.
- Resulting in enhanced productivity, sustainability, and profitability for farmers and the agriculture industry.

Any Query????

Thank you……