

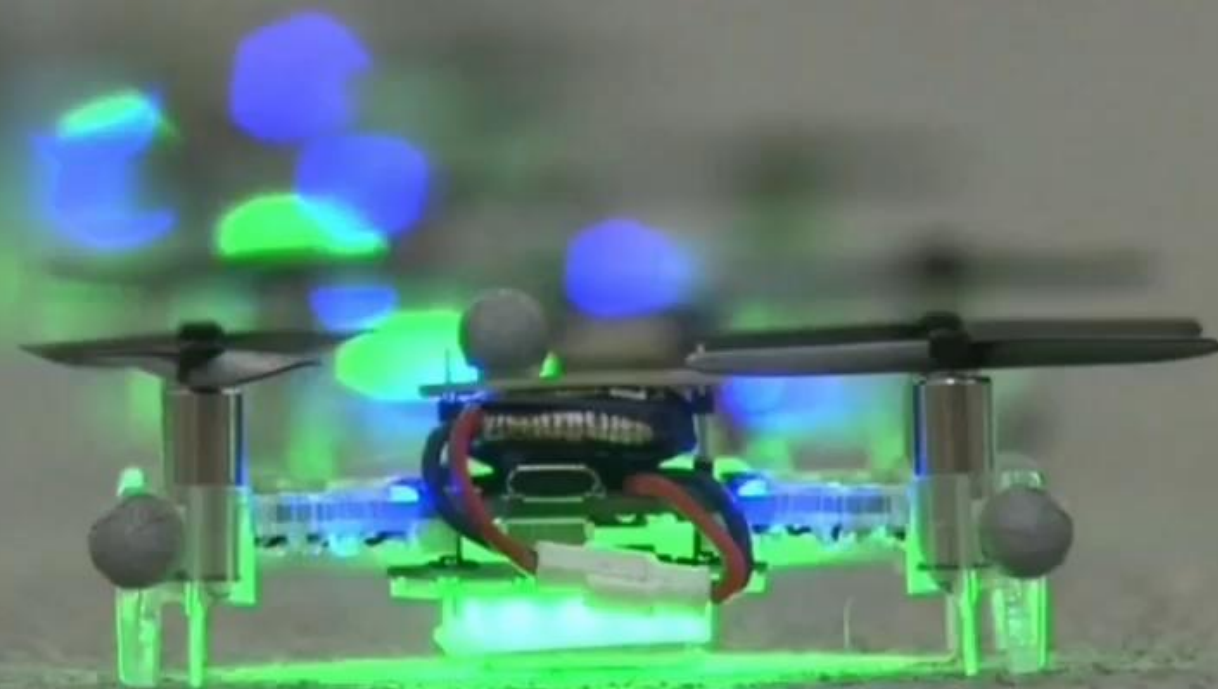
Wireless communication and its role in robotics



Presented by
Omar Almukhtar Tawfeeq



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Introduction



- **Definition of Wireless Communication:** Transmission of data without physical connections (e.g., **radio waves**, **infrared**, **Bluetooth or light**).
- **Why Wireless Communication in Robotics?**
 - 1- Reduces wiring complexity enabling robots and automated systems to operate seamlessly across dynamic environments.
 - 2- Enables remote control and automation.
 - 3- ensure smooth operations and action coordination

Wireless Technologies Used in Robotics



Technology	Use Case in Robotics	Advantages
Wi-Fi	Remote operation, cloud robotics	High speed, long range
Bluetooth	Consumer robots, smart assistants	Low power, short-range
RF (Radio Frequency)	Remote-controlled robots	Simple, reliable
Zigbee	Industrial IoT robotics	Low power, mesh networking
LoRa	Long-range outdoor robots	Energy-efficient, long range
5G & IoT	Autonomous vehicles, drones	Ultra-low latency, high speed

Role of Wireless Communication in Robotics



Remote Control & Teleoperation:



Drones & UAV plane.



Search & rescue robots



Exploration robots

Role of Wireless Communication in Robotics



- Real-time Data Transmission and Multi-Robot Collaboration : Swarm warehouses robots can communicate by sending sensor data to a central server.
- Autonomous Navigation: level 5 and level 6 Self-driving cars using 5G for rapid decision-making.
- Cloud Integration & Data Processing: **Bots** offloading processing to cloud servers.



Applications of Wireless Robotics



Industrial Automation:
Wireless robotic arms in manufacturing



Smart Homes & Consumer Robotics:
Wireless controlled robotic vacuum cleaners

Applications of Wireless Robotics



Military & Defense:
Unmanned ground and aerial vehicles.



Medical Robotics:
Telerobotic surgery
(e.g., **Da Vinci surgical system**).

Wireless Communication Challenges in Robotics



- **Latency Issues:** Delay in data transmission affecting real-time responses.
- **Signal Interference:** Overlapping signals from multiple devices.
- **Security Threats:** Hacking and unauthorized access to robotic systems.
- **Power Consumption:** Wireless modules draining battery life.



Thank you
for your attention

