

Infrared Communication: Short-Range Wireless Technology

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Introduction

- Infrared means 'below red' in the electro-magnetic spectrum.
- Wavelength: 700 nm to 1 mm.
- Used in short-range, line-of-sight communication.
- Example: TV and air conditioner remotes.
- Developed as a low-cost wireless alternative.

Basic Principle

- Communication through infrared light waves.
- Transmitter: Infrared LED.
- Receiver: Photo-diode or phototransistor.
- Data is sent as light pulses representing binary data.
- Requires direct line-of-sight between devices.

Types of Infrared Communication

1. Point-to-Point: Direct between two devices (e.g., remote and TV).
2. Diffuse: Signals reflected from walls or ceilings.
3. Ir-DA Standard: High-speed data exchange between laptops or phones (old tech).

Characteristics

- ✓ Range: 1 to 5 meters.
- ✓ Requires clear line-of-sight.
- ✓ Highly directional signals.
- ✓ Low power consumption.
- ✓ Data rate: Up to 16 Mbps (IrDA standard).
- ✓ Free from radio interference.

Advantages

- Low cost and easy to implement.
- High security — cannot penetrate walls.
- Low power usage — battery friendly.
- No interference from radio signals.
- Simple and reliable technology.

Disadvantages

- Short communication range (1-5 meters).
- Requires line-of-sight — blocked by obstacles.
- Affected by sunlight or bright indoor lights.
- Slower data rate compared to Wi-Fi or Bluetooth.
- One-to-one communication only.

Applications

- Remote controls: TVs, AC, projectors.
- Wireless data transfer (older devices with Ir-DA).
- Sensors: Motion detectors, automatic doors.
- Security systems: Intrusion detection.
- Industrial and medical instruments.

Example - TV Remote

1. Button pressed → circuit generates binary code.
2. IR LED sends modulated light pulses.
3. TV receiver detects and decodes signal.
4. TV performs the desired action.

Modern Uses

- Smart remotes and home automation systems.
- IR sensors in robotics and obstacle detection.
- Thermal imaging and night-vision cameras.
- Gesture-based control systems.

Conclusion

- Infrared is a secure, simple, and low-cost short-range communication technology.
- Works best for device control and sensor applications.
- Though replaced by Bluetooth and Wi-Fi, it remains relevant in many embedded systems.
- Invisible light continues to play a visible role in communication.