

IR Receiver & Transmitters for Remote control Applications

IRDA

- The infrared light system known commonly as the remote control device for TV set can be used as the wireless interface.
- In 1994 IBM, HP and Sharp organized the group *Infrared Data Association* or *IrDA*.
- This group developed an interface standard known by the same name IrDA .



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- To complete a measuring system with an infrared connection it is possible to use converters, for example RS232C/IrDA converter and next IrDA/USB converter.

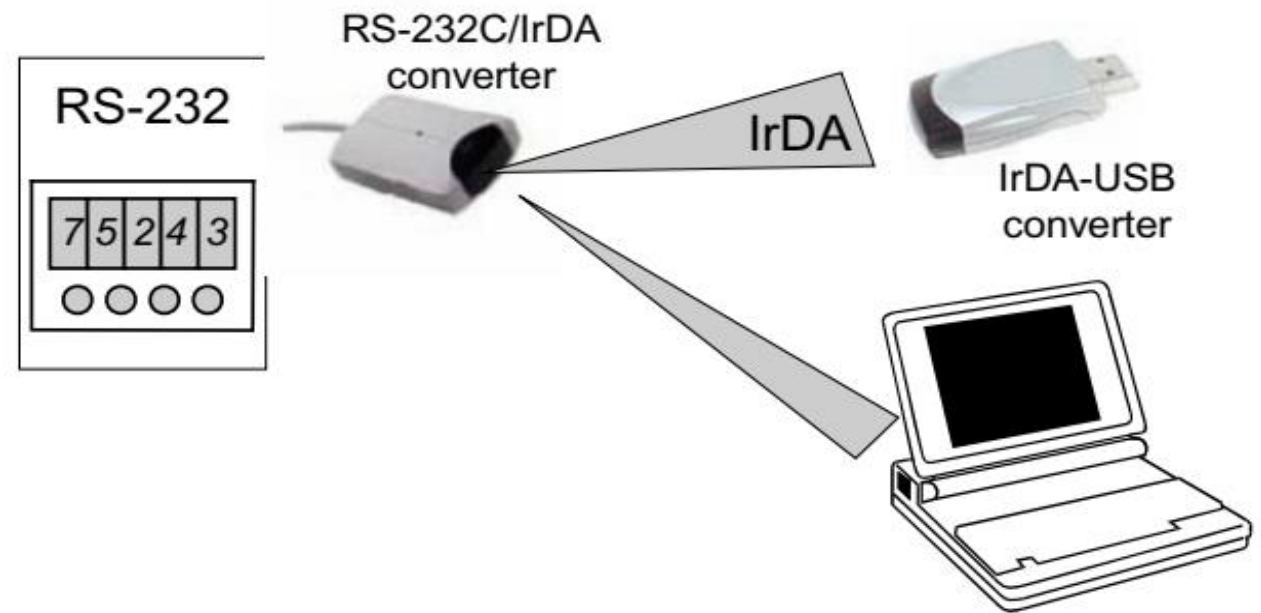


Figure: RS232/IRDA Converter

IRDA SPECIFICATIONS

- The IrDA interface utilizes infrared radiation of the wavelength 875 nm.
- The infrared LED can be used as the source of radiation.
- A typical length of infrared connection is up to one meter in presence of daylight and deflection.
- Transmission speed of IrDA 1.0 ranges from 2400 to 115200 kbps, IrDA 1.1 extends this speed to 4 Mbps.
- The pulses of LED light are modulated to the $\frac{3}{16}$ of the width of the original duration of a bit which corresponds to 1.6 Ps.
- For high speed system IrDA this pulse width is enlarged to $\frac{1}{4}$ of original one bit pulse and for speed larger than 1.15 Mbps system of modulation is more complex.

IrDA interface

- The IrDA interface is described by several protocols, for example IRPHY – infrared physical layer specification, IrLAP – infrared link access protocol, IrCOMM – infrared communication protocol, IrLAN – infrared local area network.
- A **cyclic redundancy check** is also done.

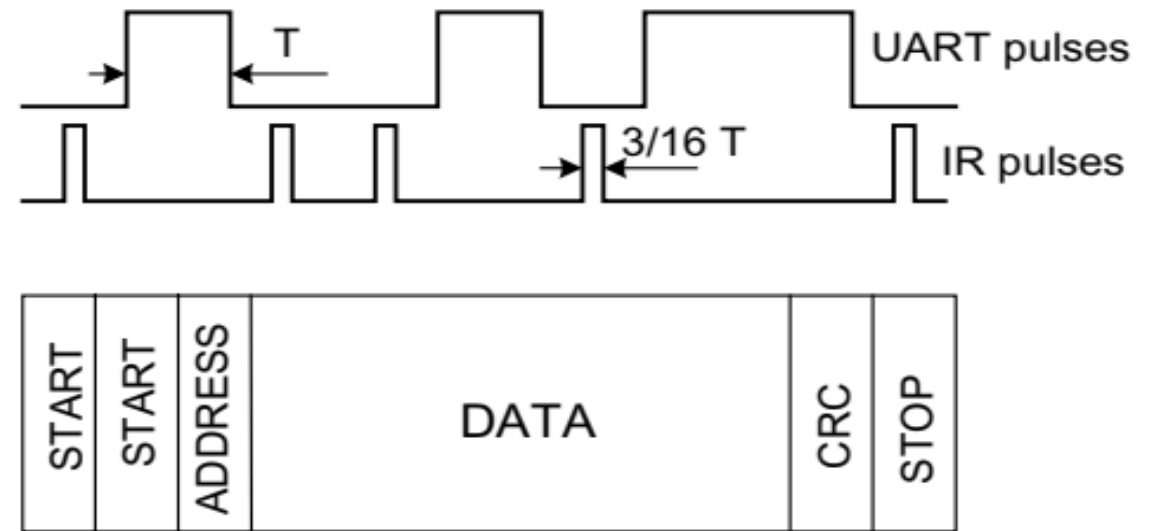


Figure: Timing Diagram of IRDA

Block Diagram of IRDA system

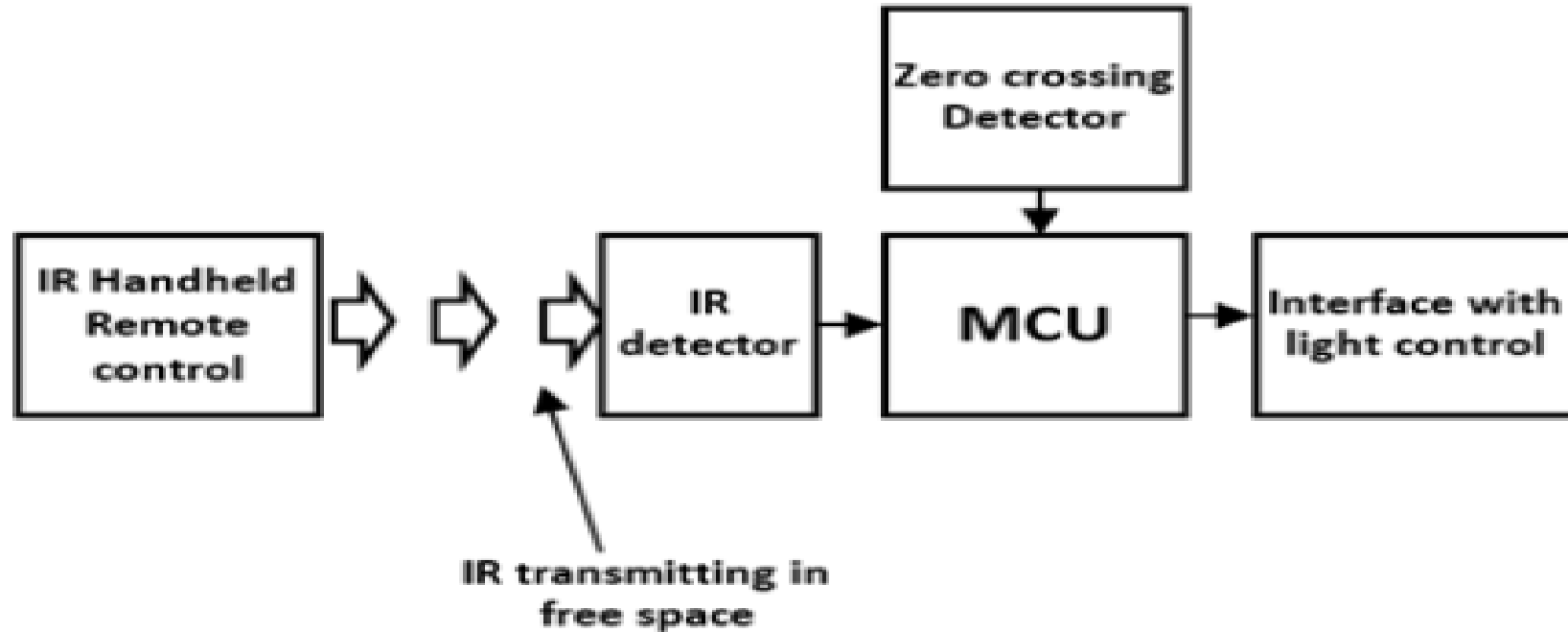


Figure: IRDA based Home light control system

IRDA Components

- IR sensor is a simple electronic device which emits and detects IR radiation in order to find out certain objects/obstacles in its range. Some of its features are heat and motion sensing.
- IR sensors use infrared radiation of wavelength between 0.75 to $1000\mu\text{m}$ which falls between visible and microwave regions of electromagnetic spectrum.
- IR region is not visible to human eyes.
- Infrared spectrum is categorized into three regions based on its wavelength i.e. Near Infrared, Mid Infrared, Far Infrared.
- **Wavelength Regions of Infrared Spectrum**
 - Near IR – $0.75\mu\text{m}$ to $3\mu\text{m}$
 - Mid IR – $3\mu\text{m}$ to $6\mu\text{m}$
 - Far IR – $> 6\mu\text{m}$

Working Principle

Infrared Sensors works on three fundamental Physics laws

- **Planck's Radiation Law:** Any object whose temperature is not equal to absolute Zero (0 Kelvin) emits radiation.
- **Stephan Boltzmann Law:** The total energy emitted at all wavelengths by a black body is related to the absolute temperature.
- **Wein's Displacement Law:** Objects of different temperature emit spectra having peak at different wavelengths that is inversely proportional to Temperature.

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- IR source (transmitter) is used to emit radiation of required wavelength.
- This radiation reaches the object and is reflected back.
- The reflected radiation is detected by the IR receiver.
- The IR Receiver detected radiation is then further processed based on its intensity.
- Generally, IR Receiver output is small and amplifiers are used to amplify the detected signal.

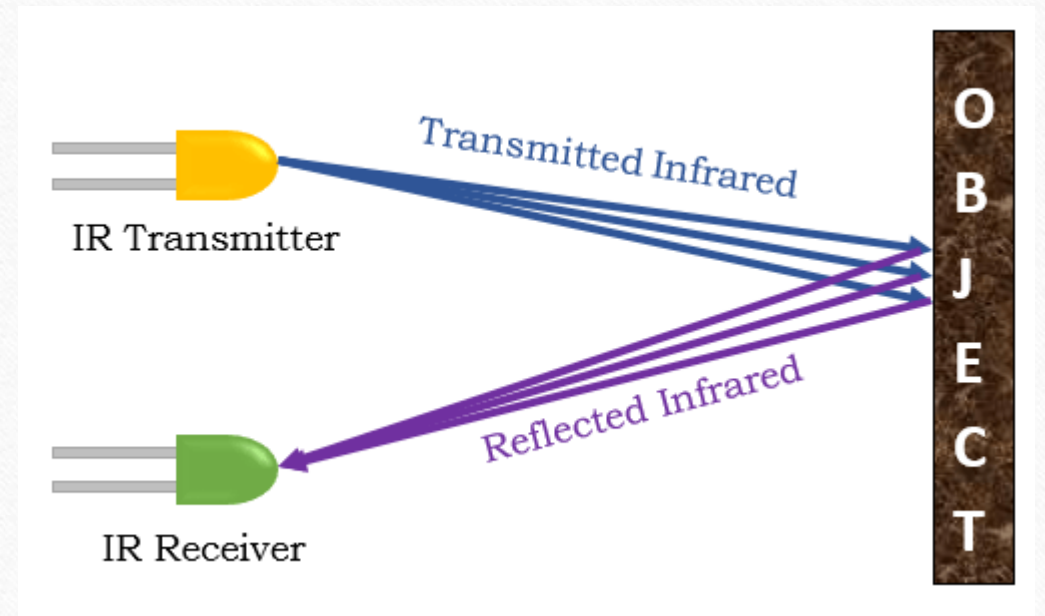


Figure: IRDA Principle of working

Elements of Infrared Detection System

- **IR Transmitter**
- IR Transmitter acts as source for IR radiation. According to Plank's Radiation Law, every object is a source of IR radiation at temp T above 0 Kelvin. In most cases black body radiators, tungsten lamps, silicon carbide, infrared lasers, LEDs of infrared wavelength are used as sources.
- **Transmission Medium**
- Transmission Medium provides passage for the radiation to reach from IR Transmitter to IR Receiver. Vacuum, atmosphere and optical fibers are used as medium.
- **IR receiver**
- IR receivers are photo diode and photo transistors. They are capable of detecting infrared radiation. Hence IR receiver is also called as IR detector. Variety of receivers are available based on wavelength, voltage and package.

Applications of Infrared Sensor

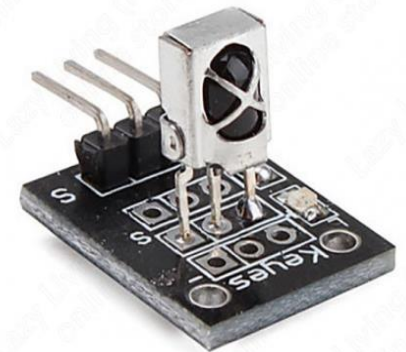
- **Proximity Sensor** These are used in smart phones to find distance of object. They use principle called Reflective Indirect Incidence. Radiation transmitted by transmitter is received by receiver after being reflected from object. Distance is calculated based on the intensity of radiation received.
- **Item Counter** -This use direct incidence method to count the items. Constant radiation is maintained in between transmitter and receiver. As soon as object cuts the radiation, item is detected and count is increased..
- **Burglar Alarm** -This is one of widely and commonly used sensor application. It is another example for direct incidence method.
- **Radiation Thermometers**- It is one of key application of Infrared sensors. Working of radiation thermometer depends on temperature and type of object.
- These have faster response and easy pattern measurements. They can do measurement without direct contact of object.
- **Human Body Detection**- This method is used in intrusion detection, auto light switches, etc. Intrusion alarm system sense temperature of human body.
- **Gas Analyzers** -Gas Analyzers are used to measure gas density by using absorption properties of gas in IR region. Dispersive and Non Dispersive types of gas analyzers are available.

Advantages of Infrared Sensor

- There is no leakage of data due to beam directionality IR radiation.
- They are not affected by corrosion or oxidation.
- They have very strong noise immunity.
- Their low power requirements make them suitable for most electronic devices such as laptops, telephones, PDAs.
- They are capable of detecting motion in presence/absence of light almost with same reliability.
- They do not require contact with object to for detection.

Disadvantages of Infrared Sensor

- Limited range.
- Can be affected by Environmental conditions such as rain, fog, dust, pollution.
- Transmission Data rate is slow.
- Required Line of sight.
- Get blocked by common objects.



References

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