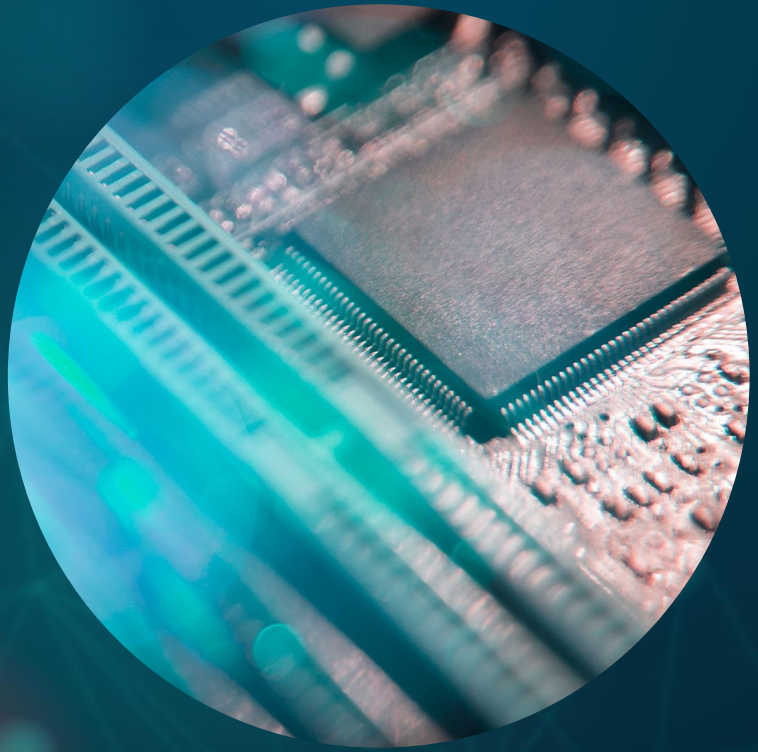
ARM Based Microcontroller

IR

Lecture 12



Advanced RISC Machines

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Introduction 01

Infra Red

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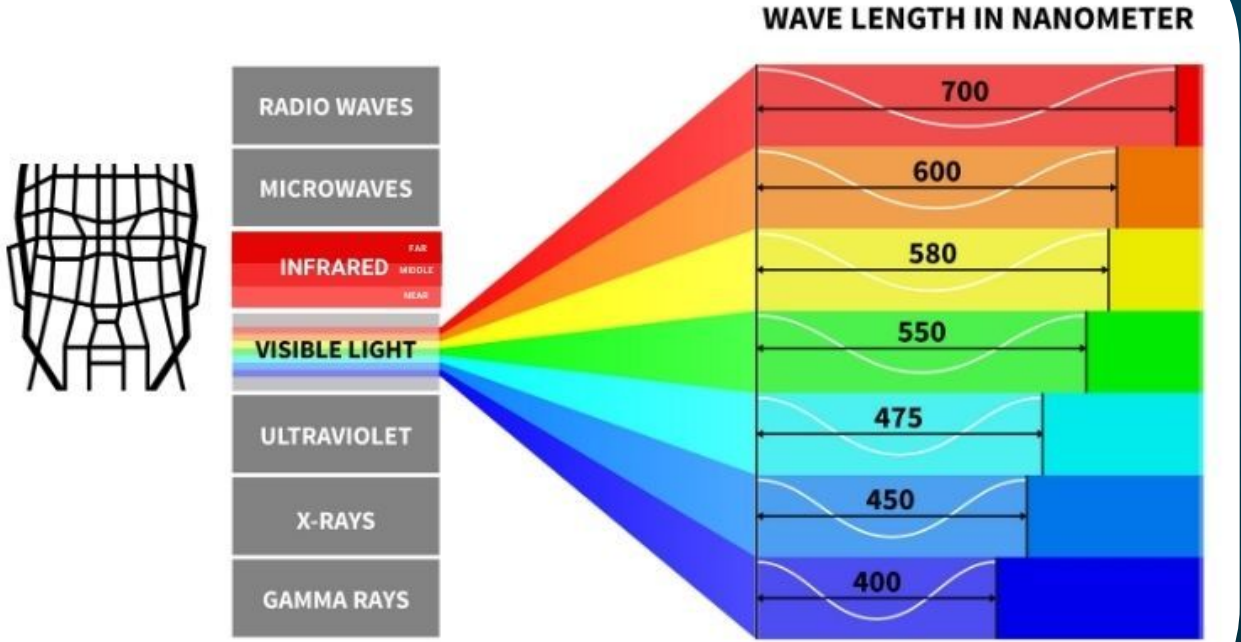
Introduction

Infrared (IR), sometimes called infrared light, is electromagnetic radiation (EMR) with wavelengths longer than those of visible light. It is therefore invisible to the human eye. IR is generally understood to encompass wavelengths from the nominal red edge of the visible spectrum around 700 nanometers (frequency 430 THz), to 1 millimeter (300 GHz)[1] (although the longer IR wavelengths are often designated rather as terahertz radiation). Black-body radiation from objects near room temperature is almost all at infrared wavelengths. As a form of electromagnetic radiation, IR propagates energy and momentum, with properties corresponding to both those of a wave and of a particle, the photon.

Infrared radiation was discovered in 1800 by astronomer Sir William Herschel, who discovered a type of invisible radiation in the spectrum lower in energy than red light, by means of its effect on a thermometer. Slightly more than half of the total energy from the Sun was eventually found to arrive on Earth in the form of infrared. The balance between absorbed and emitted infrared radiation has a critical effect on Earth's climate.

Introduction



IR 02

Communication

Infra Red

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IR Communication

R, or infrared, communication is a common, inexpensive, and easy to use wireless communication technology. IR light is very similar to visible light, except that it has a slightly longer wavelength. This means IR is undetectable to the human eye - perfect for wireless communication. For example, when you hit a button on your TV remote, an IR LED repeatedly turns on and off, 38,000 time a second, to transmit information (like volume or channel control) to an IR photo sensor on your TV.

It has many **advantages** such as:

1. Safety: Infrared radiation is not harmful to human beings. Hence infrared communication can be used at any place.
2. High Speed: All of electromagnetic radiations travel at the speed of 300,000,000 meters per second.
3. Relatively Long Distance: Distance between transmitter and receiver in IR communication system is depending on the hardware and most probably ranges in meters. Most of IR systems supports data transfer on a distance up to 10 meters.

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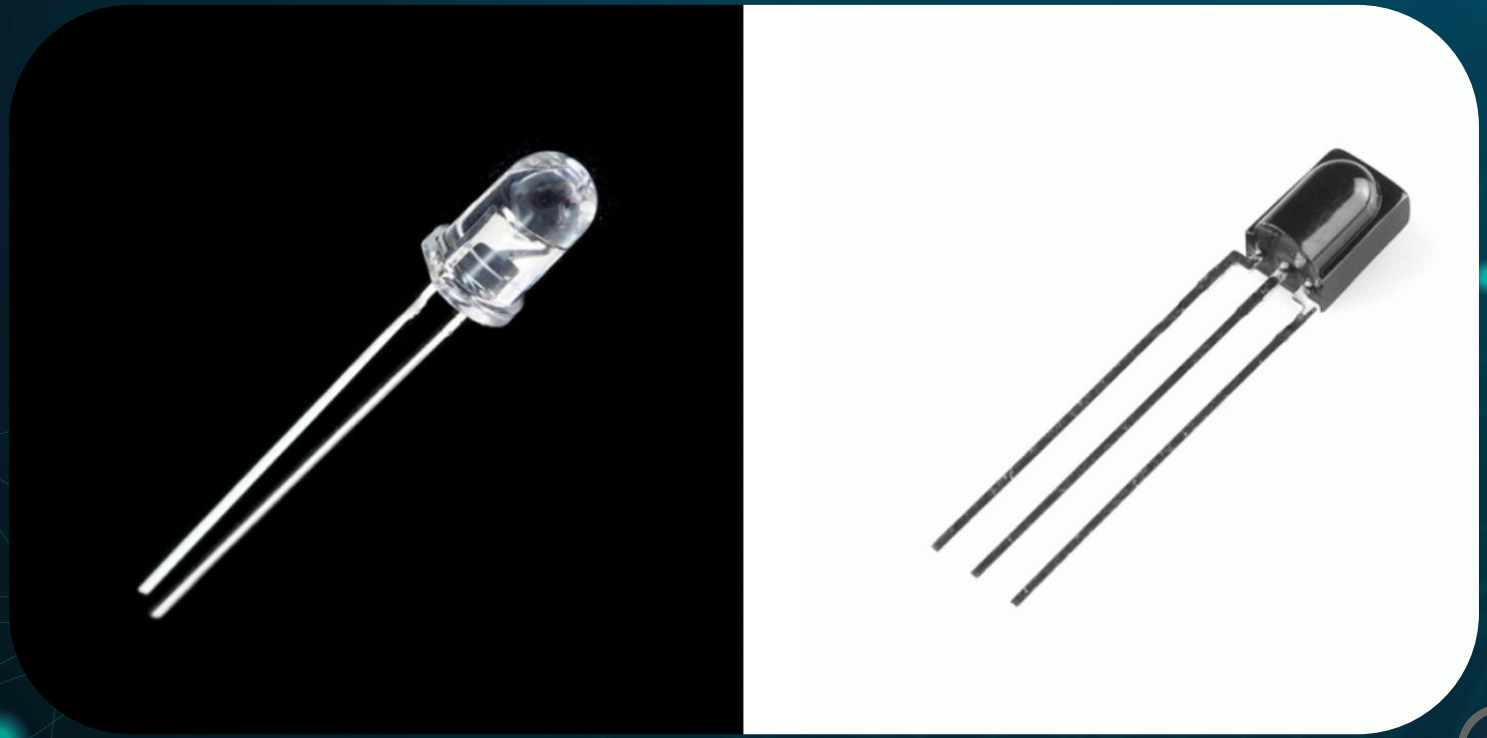
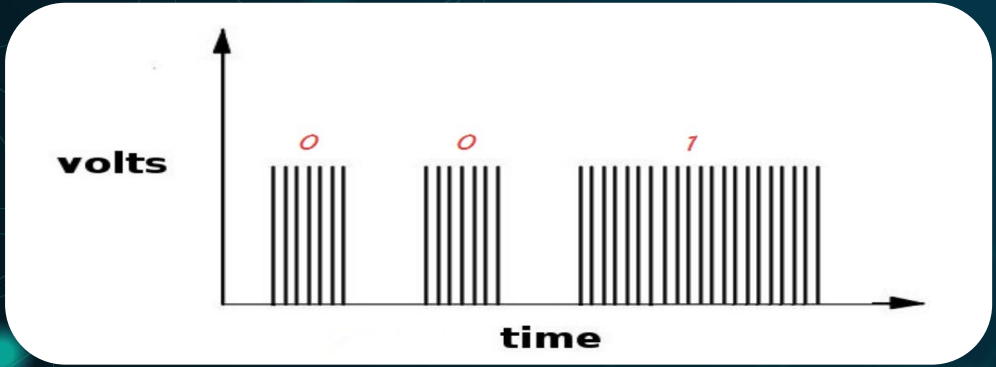
IR Communication

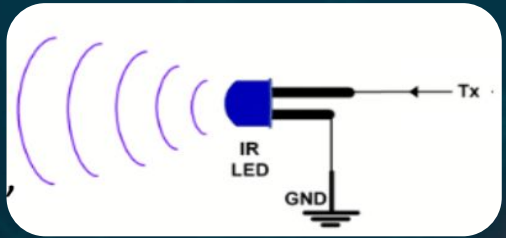


IR Transmitter

The IR transmitter is a transmitting IR LED that blinks very quickly for a fraction of time. Depending on that fraction of time, the data will be encoded either 1 or 0.

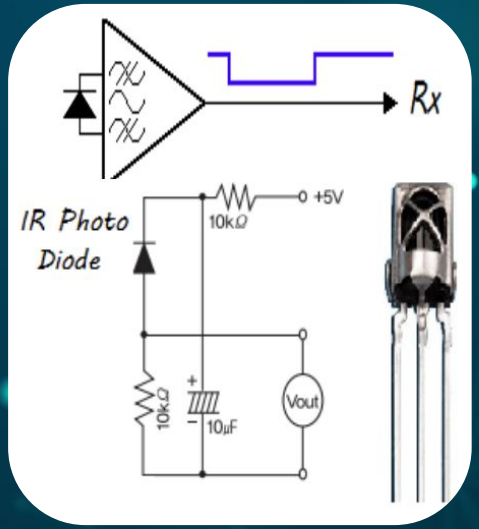
For example, let's say that digital 0 is represented by a fraction of time 0.5 ms and digital 1 is represented by a fraction of time of 2 ms. Assuming the modulation is done on 38KHz frequency; then to send 0 we will blink the LED with frequency 38KHz for 0.5ms. To send 1 we will blink the LED with frequency 38KHz for 2ms





IR Receiver

Infrared receivers are also called as infrared sensors as they detect the radiation from an IR transmitter. Normally they come in a form of photodiodes or modules based on photodiodes. Different types of IR receivers exist based on the wavelength, voltage, receiving frequency and packaging. One of the most popular modules are based on 38KHz frequency, they have a digital output that become 0 when an IR radiation of 38 KHz is received and become 1 otherwise



IR communication has many protocols identified. These protocols are different mainly in the encoding and decoding scheme.
One of the most popular protocol is **NEC** code. Other protocols are exist such as Toshiba Micom Format, Sharp Code, RC5 Code, RC6 Code, R-2000 Code, Sony Format. In our reference we will focus on NEC protocol.

Nec Protocol 03

Infra Red

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NEC

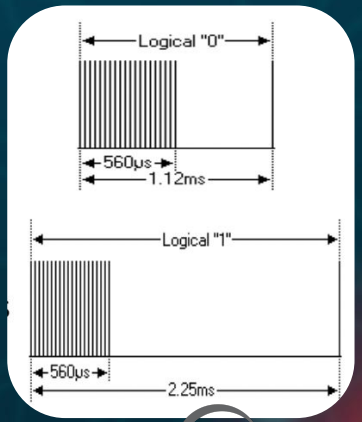
NEC has developed an IR communication protocol which is Considered as the most common used one due to its reliability and simplicity.

The NEC IR transmission protocol uses pulse distance encoding of the message bits. Each pulse burst is 562.5µs in length, at a Carrier frequency of 38kHz (26.3µs).

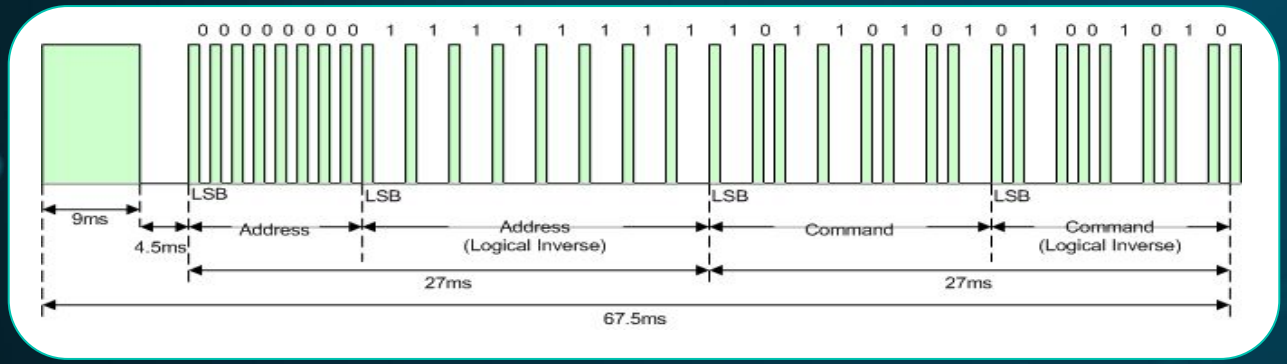
Logical bits are transmitted as follows:

- Logical 0 – a 562.5µs pulse burst followed by a 562.5µs space, with a total transmit time of 1.125ms

- Logical 1 – a 562.5µs pulse burst followed by a 1.6875ms space, with a total transmit time of 2.25ms



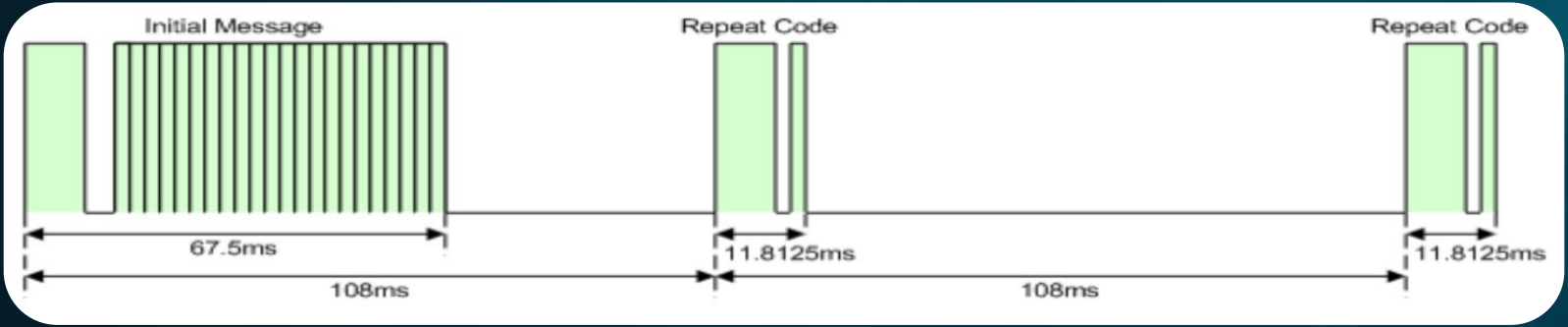
Nec Frame



When a key is pressed on the remote controller, the message transmitted consists of the following, in order:

9ms leading pulse burst
4.5ms space
8-bit address for the receiving device
8-bit logical inverse of the address
8-bit command
8-bit logical inverse of the command
562.5µs pulse burst to signify the end of message transmission.

Repeat Code



If the key on the remote controller is kept pressed, a repeat code will be issued, typically around **40ms** after the pulse burst that signified the end of the message.
A repeat code will continue to be sent out at 108ms intervals, until the key is finally released. The repeat code consists of the following, in order:
9ms leading pulse burst
2.25ms space
562.5µs pulse burst to mark the end of the space

Important Note
At the receiver side, the burst is received as 0 and the space is received as 1.

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Session LAb

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THANKS!

Do you have any questions?

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