Relays & Optocouplers

Many people have remotely controlled sockets that allow for easy control of AC appliances using a remote. These sockets contain internal switches capable of handling mains voltage. Inside the socket, components include a fuse, radiofrequency PCB, HX2272 IC (remote control encoder), and a relay. The relay acts as an electromechanical switch that clicks when toggled on or off.
Relays come in various designs but generally consist of a coil and at least two contacts.
A relay's casing provides essential information such as coil voltage; applying this voltage activates the relay by creating a magnetic field. When energized, the relay closes its contacts, allowing current to flow to connected appliances.
Common relay types include Normally Open (NO), Normally Closed (NC), and changeover contacts with different switching capabilities.
Applying too low voltage may prevent activation while excessive voltage can cause overheating or short circuits in the coil.
A simple circuit can be created to turn on/off small light bulbs using relays; however, there are potential issues with voltage spikes when deactivating coils.
To protect against overvoltage caused by collapsing magnetic fields when deactivating coils, flyback diodes should be added parallel to the coil.

While MOSFET and TRIAC have inherent power losses due to their voltage drops under load conditions, relays maintain lower power loss even at high currents.
Relays provide galvanic isolation between control signals (e.g., 5V from microcontrollers) and high-voltage loads (e.g., 230V).

Although relays are effective for switching large loads safely, they are slower than solid-state devices like MOSFET or TRIAC which can handle rapid switching.
For controlling AC circuits at specific frequencies (like 50Hz), optocouplers serve better than relays due to their ability to manage phase angles effectively.