Lighting Control System:

Lighting controls play a critical role in lighting systems, enabling users manually or automatically to:

• Adjust light output up and down using a dimmer.

• Turn the lights ON and OFF using a switch.

Lighting controls are input/output devices and systems. The control system receives information, decides what to do with it, and then adjusts lighting power accordingly. Here we see a basic lighting circuit (switch leg). Power travels along the circuit to energize a group of lights. This lighting system supplies illumination.

Control Strategies:

Combining various inputs and outputs results in several unique lighting control strategies available that can address visual needs, energy management needs, or both. In turn, control strategies can be combined in the same space via layering to maximize value.

• Manual control
• Occupancy sensing
• Time scheduling
• Daylight response
• Institutional task tuning
• Color tuning
• Data generation
• Demand response

Effects of Lighting Control System	
What	**How**
Produce the right amount of the lighting control	Light output (intensity) Dimming
Where the Light is needed	Zoning of Luminaires to controllers
When the Light is needed	Automatically reduce the Lighting when the space is unoccupied
Produce light at the right colour or shade of white light	Separately dimming the arrays of LED's with different colors of the white light correlated colour temperatures (CCTs)
Allows remote programming and control	Control Systems with programming and lighting management capability
Tells you how lights are performing	Centralized intelligent control systems with measuring and/or monitoring/alarm capacity
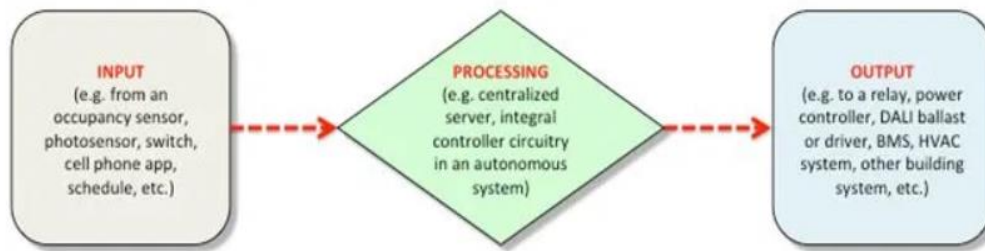
Flowchart shows the input to output control process

Benefits of Lighting Control System:

By adjusting the intensity of one or more layers of lighting in a space, lighting controls can:

1.Convenience
The first is convenience. This comes in many forms, from pressing one button to turn off all of the lights in your home, to using a tabletop keypad rather than getting up to hit a switch on the wall, using your phone to adjust lights from anywhere, or having lights adjust automatically according to sensors, time of day, or sunrise and sunset.

2.Elegance
Next, we have elegance. This benefit is purely visual, but isn't that one of the most important aspects of lighting? This is where the concept of dimming plays a big role: rather than dealing with harsh, glaring overhead light turned to full brightness, lighting control allows you to paint your space in beautiful layers of light. A home's interiors should be displayed in the best light and accented in the right places; lighting control makes that possible.

3.Aesthetics
The third benefit is aesthetics, which refers to the look of the controls on the wall. Think of a bank of several light switches on a wall in your home; not visually appealing. Consolidating those switches into a couple of keypads with engraved buttons makes for a dramatic improvement, with screwless faceplates in a color or material to match the wall.

4. Safety
Next, safety. Lighting control can act as a great deterrent, and therefore a preventive safety measure. Vacation mode sets lighting scenes to turn on at random times, giving the look of a lived-in home to anyone who may be watching. The lighting control system can also be integrated with a home's alarms, illuminating the path to exit the home in the event of a fire, or turn all lights to full bright and flash to confuse an intruder.

5.EnergySavings

Lastly, energy savings. Lighting control by nature is a green solution. Just by virtue of being able to dim your lights to mid-level rather than full brightness, you are saving energy and prolonging the life of your lightbulbs. In fact, it is the only technology we know of that saves energy while making you more comfortable. Dimming aside, the ability to turn off all of the lights as you're leaving with one press of the All Off button, is also a time-saving way to ensure that you're not wasting energy by leaving lights on in an empty house.

Globally recognized Protocols for Lighting Control System:

1.KNX:

KNX lighting control allows you to keep control of energy usage in buildings and is a key contributing factor in protecting the environment. Controls using KNX can facilitate this control. They can provide a comfortable working environment for building occupants, enhancing productivity, ensure compliance with current energy legislation and contribute significantly to reducing energy usage leading to a smaller carbon footprint.

Open communication between building systems facilitates straight forward and secure integration of third part systems at all levels, the standardization and independent communication that KNX provides ensures development and exchange of information between systems across the automation and field levels within the building automation topology.

KNX delivers lighting control, all equipment required for independent control and monitoring of building services plants as well as recording data. This covers the whole spectrum from individual room controllers up to integrated control systems. You can also link the lighting control, solar protection and any special plants to the traditional HVAC control.

The versatility of the KNX protocol provides a flexible approach to room control and HVAC, whilst allowing easy integration to third party systems through a number of gateways available to automation platforms such as BACNET.

2.BACnet:

BACnet is arguably the predominant communication protocol used in so-called building automation and control (BAC) networks. The network platform is used in data delivery between building automation systems (BAS) such as networked lighting systems and building management systems (BMS)/energy management systems (EMS) for monitoring, control, and analytics. This fully open protocol was developed by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) with the first publication in 1995. While BACnet is utilized far more today in applications such as HVAC (heating, ventilation, and air conditioning) as opposed to lighting, the protocol can serve in solid-state lighting (SSL) applications. Let's discuss BACnet technology in detail and consider how it might be used in conjunction with networked smart lighting as we move to the Internet of Things (IoT) era.
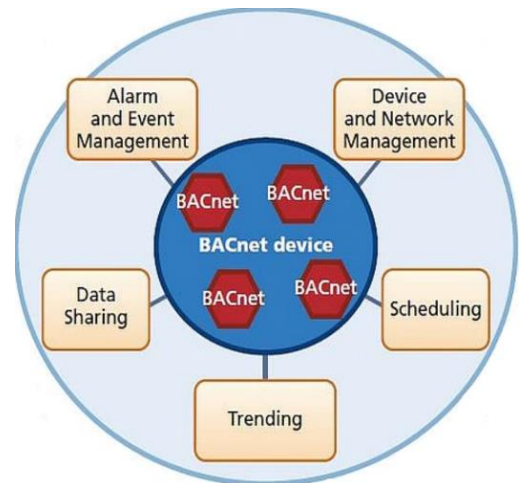
3.LON:

The LONWORKS platform is the leading open solution for building and home automation, industrial, transportation, and public utility control networks. The LONWORKS platform is accelerating the trend away from proprietary control schemes and centralized systems by providing interoperability, robust technology, faster development, and economies of scale. Distributing the processing throughout the network using an open control networking protocol and providing easy access to every device lowers the overall installation and life cycle costs, increases reliability by minimizing single points of failure, and providing the flexibility to adapt the system to a wide variety of applications. For example, in the building control industry, LONWORKS networks are used to provide a common infrastructure for all building systems. This allows the building automation system designed to eliminate excessive vertical integration, which is the often the reason for vertical isolation.
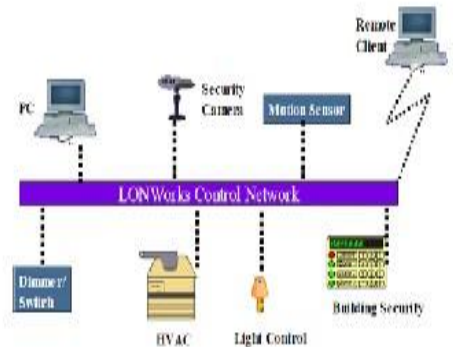
4.DALI:

A DALI network consists of at least one application controller, input devices (e.g. sensors and push-buttons), bus power supplies (which may be built into any of the products), control gear (e.g., electrical ballasts, LED drivers and dimmers) that have DALI interfaces. Application controllers can control, configure or query each device by means of a bi-directional data exchange. The DALI protocol permits devices to be individually addressed and it also allows multiple devices to be addressed simultaneously via group and broadcast messages.
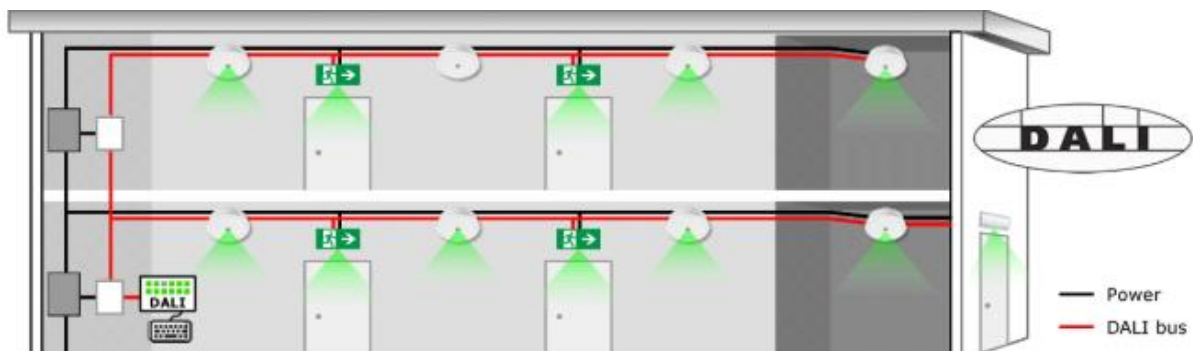
5.DMX:

DMX512 (Digital Multiplex) is a standard for digital communication networks that are commonly used to control stage lighting and effects. It was originally intended as a standardized method for controlling light dimmers, which, prior to DMX512, had employed various incompatible proprietary protocols. It soon became the primary method for linking controllers (such as a lighting console) to dimmers and special effects devices such as fog machines and intelligent lights. DMX has also expanded to uses in non-theatrical interior and architectural lighting, at scales ranging from strings of Christmas lights to electronic billboards. DMX can now be used to control almost anything, reflecting its popularity in theaters and venues. A DMX512 network employs a multi-drop

bus topology with nodes strung together in what is commonly called a daisy chain. A network consists of a single DMX512 controller – which is the master of the network — and one or more slave devices. For example, a lighting console is frequently employed as the controller for a network of slave devices such as dimmers, fog machines and intelligent lights.DMX512 employs EIA-485 differential signaling at its physical layer, in conjunction with a variable-size, packet-based communication protocol. It is unidirectional.