

Project

The **Advanced Light Intensity Indicator (ALII)** module is an innovative solution designed to monitor and indicate light intensity levels, providing an average intensity over a specified period.

This module plays a crucial role in energy conservation. By providing real-time data on light intensity, it allows for the efficient use of artificial lighting systems. Lights can be dimmed or switched off when natural light is sufficient, leading to significant energy savings.

Furthermore, the ALII module contributes to creating safer cities. By ensuring adequate lighting in public spaces, it can help prevent accidents and deter criminal activity, enhancing the safety of our urban environments.

The ALII module can also be integrated with solar panels, making the system self-sustaining and promoting the use of renewable energy sources. The solar panels can power the ALII module during the day, with excess energy stored for use during nighttime or cloudy conditions.

Your task is to architect the ALII module, incorporating the following features.

1. Before processing the light intensity data, the module should include an analog filtering stage to eliminate unwanted electrical noise that may appear on the power line supplying the LDR circuit. Such interference, typically at 50–100 Hz, can cause flickering or unstable readings in artificial lighting environments. A carefully designed low-pass or notch filter must therefore be implemented to smooth the LDR output and remove these components while preserving genuine changes in ambient light. This stage ensures that the system measures only true variations in light intensity, providing a clean and reliable signal for subsequent processing and display.
2. A Light Dependent Resistor (LDR) is used to sense the light intensity. This data is then depicted on a seven-segment display, which is set up to show light levels from “0” (lowest) to “7” (highest). This setup enables the module to accurately measure and display varying light intensities in a compact and efficient manner.
3. The module should also include a feature to avoid sudden variations in light intensity. The system should only indicate the output once the light has been stable for a certain period, adjustable between 30 and 300 seconds. A variable resistor can be incorporated to adjust this period. Additionally, a switch should be included to enable or disable this feature as needed. This ensures that the module provides accurate and stable readings, avoiding false triggers due to temporary light fluctuations.

4. The module should also incorporate an additional seven-segment display to indicate the average light intensity over a specified period, adjustable between 300 and 900 seconds. A variable resistor can be used to modify this period. To ensure flexibility and control, a push button should be included to reset the average light intensity reading. This feature allows for a comprehensive understanding of light conditions over an extended period, providing a more accurate and holistic view of the lighting environment.

Note

1. **Programmable ICs** are not allowed.
2. **Pre-built ICs** that render a specified task are not allowed.
3. You **can use** gate ICs and flip-flops.

What to Upload?

A folder containing,

1. **All simulation files** that you used to create the final task.
2. A **short screen video** (less than 8 minutes) of the working simulation that shows all working features.
3. A **document** (less than 15 pages) which includes:
 - Brief explanations of how you achieved each feature, explaining key decisions and assumptions made, and screenshots of relevant circuit parts.

Note

- A physical demonstration accompanied by a viva will be conducted to evaluate the system's functionality and individual contribution.