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RESEARCH ARTICLE OPEN ACCESS

Automatic Night Lamp Using LDR

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ABSTRACT
This project focuses on designing a night lamp that automatically turns on in the absence of light and gets turned off in the presence of light using a light-dependent resistor (LDR). The LDR is a sensor whose resistance decreases with increasing light intensity, enabling it to detect ambient light levels. When the surrounding light falls below a certain threshold, the circuit activates the lamp using a transistor as a switch. The design is simple, cost-effective, and energy-efficient, making it ideal for applications in homes, streets, and gardens.

Keywords - Light Dependent Resistor (LDR), Transistor, LED or bulb.

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I. INTRODUCTION

In today's world, there's a strong emphasis on efficiency and automation. To this end, we have developed an automatic night lamp that utilizes an LDR (Light Dependent Resistor) sensor to detect ambient light levels. This system intelligently switches on the lamp automatically when darkness falls. This design has the potential to be implemented in various applications such as street lights public parks, and outdoor home lighting. By automatically activating only when necessary, this project aims to significantly reduce energy consumption compared to conventional, always-on lighting solutions. [1].

II REQUIRED COMPONENTS

LDR: An LDR (Light Dependent Resistor), also known as a photocell or photo-conductor, is a type of resistor whose resistance changes in response to the amount of light it receives. The resistance decreases in the presence of light, while it increases in darkness. LDRs are commonly used in circuits where light detection is needed. For example, they can be used to automatically turn a light on when it's dark and off when it's bright. A typical LDR has a resistance of around 1MΩ in complete darkness and a few k Ω under bright light. These sensors are widely used in various applications, including light sensing and control systems [2].

Key Properties of an LDR:

1. High Resistance in darkness: The resistance can be in the range of Mega-Ohms without light.
2. Low Resistance in brightness: When exposed to strong light, the resistance drops to a few hundred ohms or less.

3. Non-linear Behavior: The relationship between resistance and light intensity is not linear.

Fig 1. Light Dependent Resistor

TRANSISTOR: The BC547 is an NPN bipolar junction transistor often used as a switch or amplifier in circuits. In an automatic night lamp circuit using an LDR (Light Dependent Resistor), the BC547 plays a crucial role in controlling the lamp based on ambient light levels, also the light levels for the future prediction. Here's how it works [3]:

1. LDR's Role: The LDR changes its resistance based on light intensity. In darkness, the LDR's resistance is high, while in bright light, its resistance is low.
2. Voltage Divider: The LDR and a fixed resistor form a voltage divider. This setup generates a variable voltage depending on the ambient light intensity.

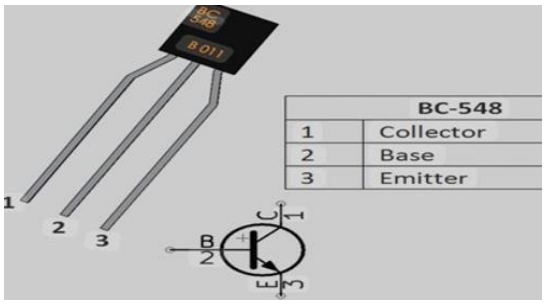

Fig 2. BC547 Transistor

3. Transistor Operation:

During daylight (or bright conditions), the LDR's low resistance reduces the voltage at the base of the BC547 below its threshold. This keeps the transistor in the cut-off state, preventing current flow to the lamp.At night (or in low light), the LDR's resistance increases, raising the base voltage of the BC547 above the threshold. This switches the transistor to the saturation state, allowing current to flow and turning on the lamp .

BATTERY: To ensure adequate electrical supply for the automatic night lamp's development circuit, a 9V battery is employed. The circuit utilizes an LDR to sense changes in ambient light and automatically turn the lamp on or off [4].

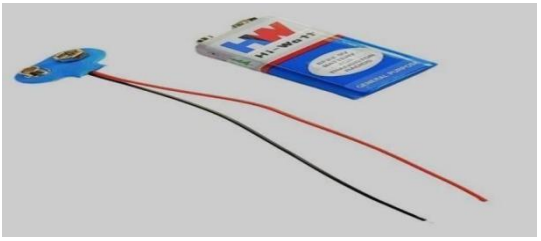

Fig 3. 9V Battery

III BLOCK DIAGRAM

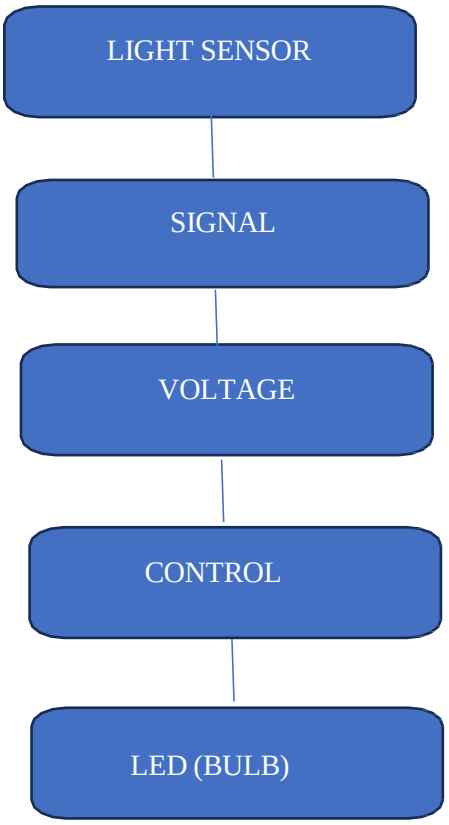

Fig 4. Block Diagram

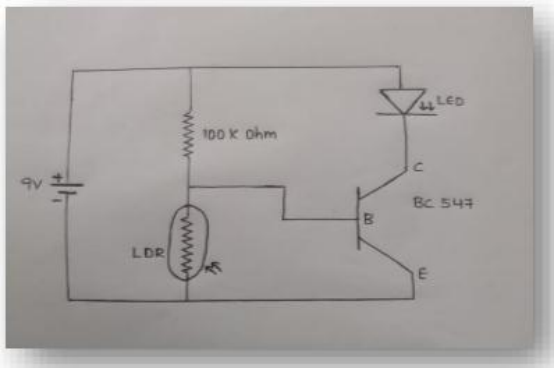

Fig 5. Circuit representing Automatic Night Lamp Using LDR

The circuit is constructed as shown in the figure helps in understanding and developing a circuit that turns on light when it is dark. From the figure, we come across a few key components.
Input section: battery used to supply power and environmental light conditions [5].

Output Section: It uses a Transistor (BC547) to switch the lamp on or off based on the light detected by the LDR. When the LDR detects low light, it triggers the transistor, powering the lamp,by collecting the data from the Sensor, it can be useful for the future prediction to install the more LDR's by predicting the previous data installation. [6]

IV WORKING

The working of the automatic night lamp circuit relies on the light-sensitive properties of the LDR and the switching capability of the BC547 transistor. During daylight, the LDR's resistance decreases due to high light intensity, which lowers the voltage at the base of the BC547 transistor. As a result, the transistor remains OFF, preventing current flow to the LED, and keeping it unlit. In darkness, the LDR's resistance increases, raising the base voltage of the BC547 transistor. This activates the transistor, allowing current to flow through it and powering the LED, which lights up. Thus, the circuit efficiently senses ambient light levels and automatically controls the LED, ensuring illumination only in the absence of light [7].

V RESULTS & DISCUSSION

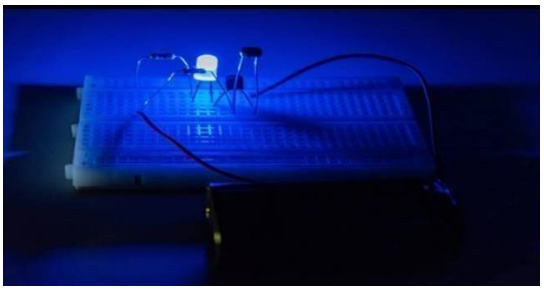

Fig 6. C ircuit displaying the working LED in presence of dark light

Fig 7. Application of Automatic Night Lamp Using LDR in street light Model

Advantages:

Energy Saver: Turns on only when it's dark, cutting energy waste.
Effortless Convenience: No need to switch it on or off manually.
Eco-Friendly: Reduces energy use, helping the planet.
Safe and Reliable: Lights up automatically, improving nighttime visibility.
Pocket-Friendly: Saves money on electricity and uses affordable components.
A simple yet innovative solution for smarter lighting combines simplicity, automation, and efficiency, making it a practical choice for modern lighting solutions [8].
Future Enhancement:

Although the application meets its primary objectives, there is significant potential for expansion and improvement to offer enhanced benefits to users. Future enhancements could include:
Enhanced Power Source: Improve the lifetime and durability of the battery source. Use highly efficient batteries.
Smart Connectivity: Implement a remote control system through a smartphone by integrating Bluetooth or Wi-Fi Modules to allow users to adjust the light behavior via a smart home system.
Weather-Tolerant Framework: As the street lights and the light systems are intended to be used outdoors, ensure that all components are Moisture resistant.
Timed Activation: Incorporate a timer to enable lamp function only during specific hours and optimize its activation schedule automatically.
Hybrid Power System: Allow the lamp to switch

between solar power and electricity based on the power source.

By Incorporating these upgrades, the application can continue to adapt to the needs of the user and environmental conditions. These future improvements will enhance its functionality, making it a reliable and innovative lighting solution for various applications.

VI CONCLUSION

The automatic night lamp using an LDR is an efficient, cost-effective system that saves energy by turning lights on/off based on ambient light levels. While simple and practical, it requires proper installation and maintenance for optimal performance. It's ideal for basic use but can be enhanced with advanced technologies for smart applications. The automatic night lamp using an LDR is an energy-efficient solution for future generations, thus promoting sustainability by reducing energy wastage. With advancements, it can be integrated into smart systems, paving the way for smarter and greener lighting solutions.

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