# Smart Street Lighting: Automated Control and Fault Detection System Using LED and Transistor Networks

Karthigeyan. G

26th April 2024

**Abstract:**

In this paper, we present a novel approach to street light automation and fault detection system using LED and transistor networks. The system employs light-dependent resistors (LDRs) and transistor networks to control street lights automatically based on ambient light conditions. Each street light is equipped with an LDR, which triggers an LED and activates the corresponding transistor network when ambient light decreases, ensuring efficient street lighting during nighttime. Additionally, the system incorporates a fault detection mechanism by employing identical transistor networks connected to a fault LED at the control centre. In the event of a malfunction in a street light, such as LED failure, the corresponding transistor in the network activates the fault LED, signalling the location of the faulty street light for timely maintenance. Experimental results demonstrate the effectiveness and reliability of the proposed system in providing automatic street light control and efficient fault detection capabilities.

## Introduction:

Street lighting plays a crucial role in ensuring safety and security in urban environments, providing illumination for pedestrians, motorists, and residents during nighttime hours. Traditional street lighting systems often rely on manual switching or timer-based controls, which may not adapt effectively to changing ambient light conditions or detect faults in individual street lights. To address these limitations, we propose a novel approach to street light automation and fault detection system using LED and transistor networks.

In this paper, we present a comprehensive system that integrates automatic street light control with a fault detection mechanism to enhance the efficiency and reliability of urban lighting infrastructure. Our system utilizes light-dependent resistors (LDRs) and transistor networks to enable automatic control of street lights based on ambient light levels. Each street light is equipped with an LDR, which activates an LED and triggers the corresponding transistor network when ambient light decreases, ensuring optimal illumination during nighttime while conserving energy during daylight hours.

Furthermore, our system incorporates a fault detection feature that facilitates the timely identification and resolution of issues in individual street lights. By employing identical transistor networks connected to a fault LED at the control centre, our system can detect malfunctions such as LED failures or other issues in street lights. When a fault is detected, the corresponding transistor in the network activates the fault LED, providing a visual indication of the faulty street light's location for prompt maintenance and repair.

Through experimental validation, we demonstrate the effectiveness and reliability of our proposed system in providing automatic street light control and efficient fault detection capabilities. By harnessing the power of LED and transistor technologies, our system offers a scalable and cost-effective solution for enhancing urban lighting infrastructure, improving safety, and reducing maintenance overhead in smart cities.

**Methodology:**

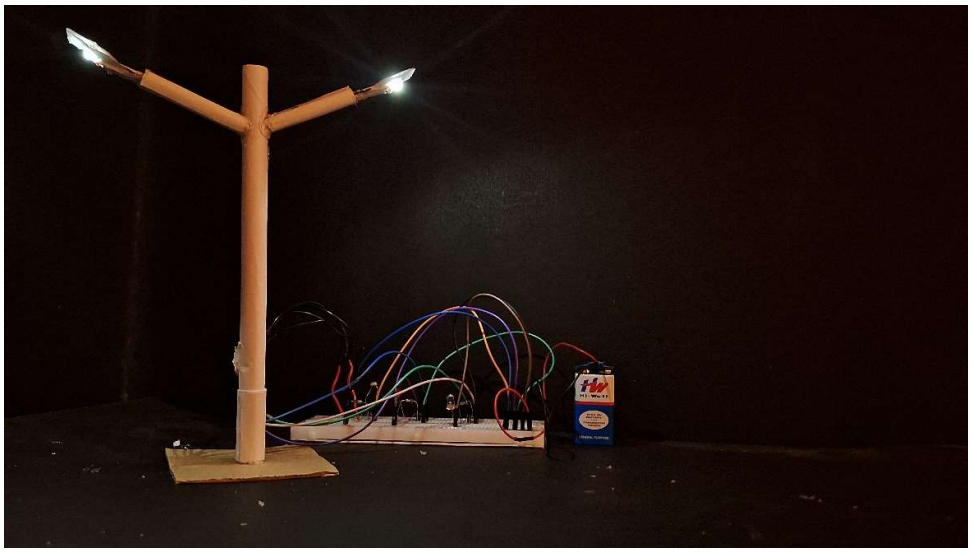
Automatic Street Light Control System:

- Utilized LED and transistor networks for automatic control of street lights.
- During nighttime, when ambient light is low, the LED in the network activates, triggering the transistor to turn on the street light.
- Each street light is equipped with a light-dependent resistor (LDR) at the LED.
- When ambient light decreases, the LDR's resistance increases, activating the LED and turning on the street light.

Fault Detection System:

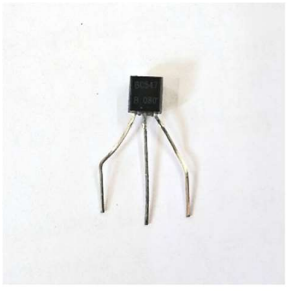
- Implemented identical LED and transistor networks for fault detection.
- Positioned a fault LED at the control centre, connected to each street light's transistor network.
- In the event of a malfunction in a street light, such as LED failure or other issues, the corresponding transistor in the network activates the fault LED at the control centres.
- This indicates the location of the faulty street light, allowing for prompt maintenance and repair.

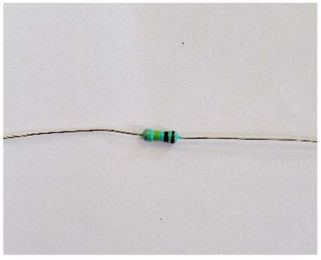
**Experimental Setup:**



**Equipments:**

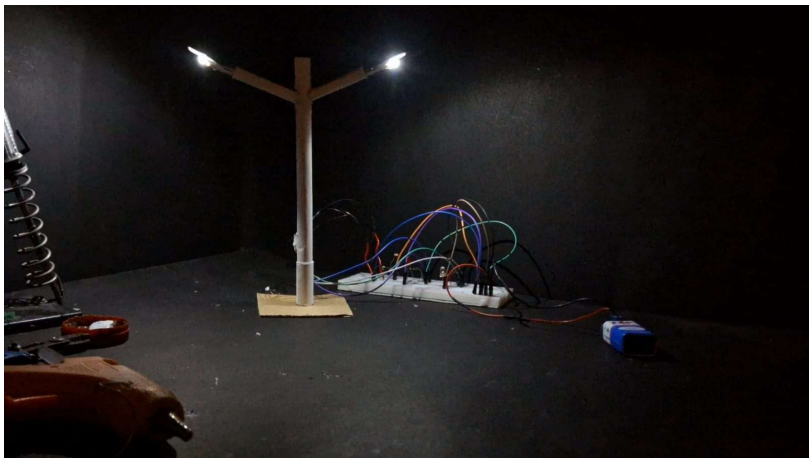
- BC547 Transistor
- LED (To Acknowledge Fault)
- LED (Street Light)
- 100k ohm Resistor
- 9v Battery
- Connecting wires
- Breadboard

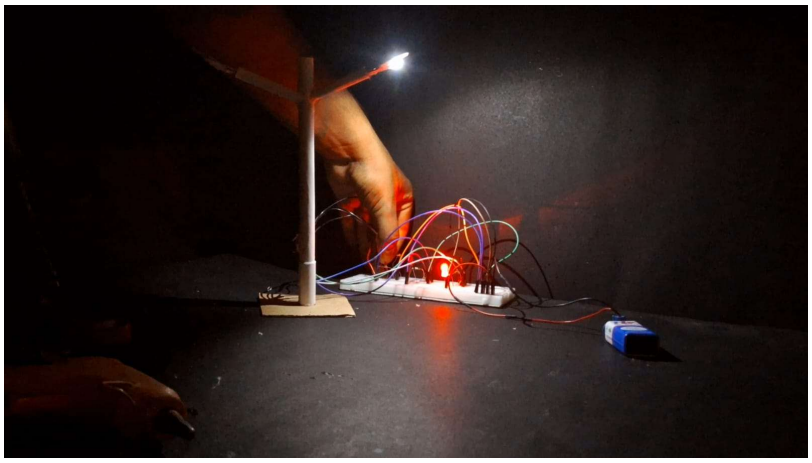


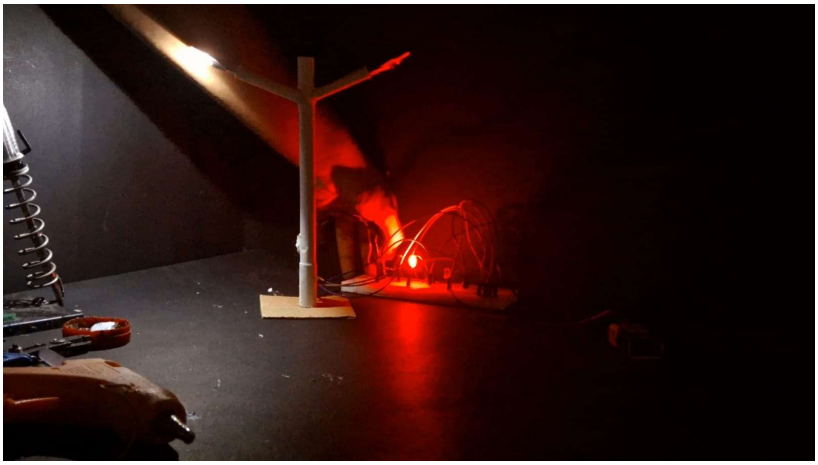


**Results:**

The Working images of the model is shown below







**Conclusion:**

In this study, we proposed and implemented a novel approach to street lighting management, integrating automated control and fault detection functionalities using LED and transistor networks. Our system demonstrated effective automatic control of street lights based on ambient light conditions, ensuring optimal illumination during nighttime while conserving energy during daylight hours. Additionally, the fault detection mechanism successfully identified issues in individual street lights, enabling prompt maintenance and repair to enhance overall system reliability.