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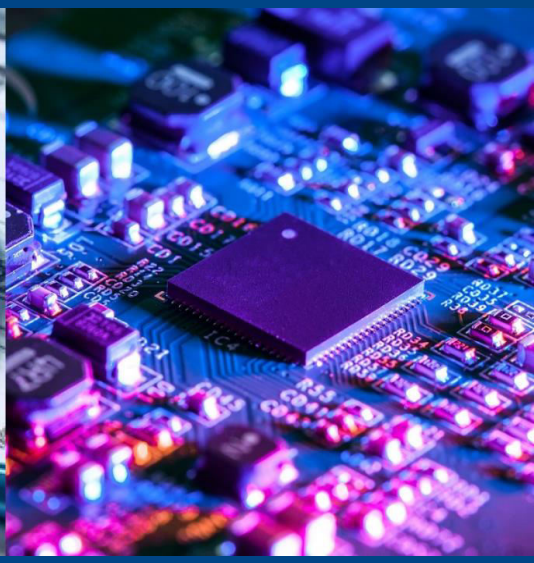

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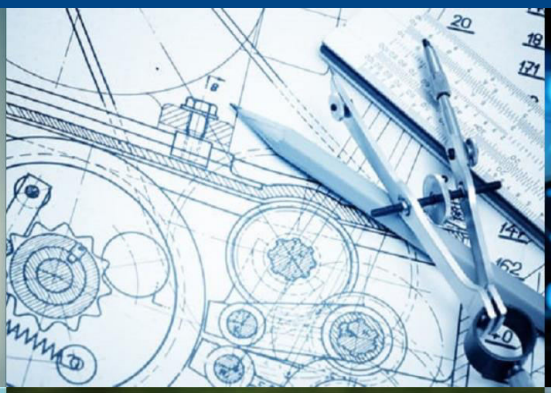

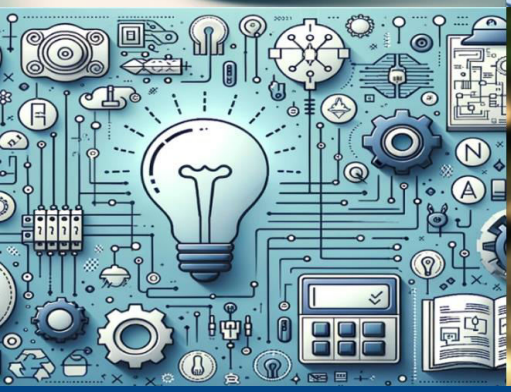

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Automatic Room Light Controller with Bidirectional Visitor Counter

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ABSTRACT: This project focuses on the design and implementation of an automatic room light control system with a bidirectional visitor counter using a logic trainer (EES 2001). The main objective is to automate the switching of room lights based on occupancy while also counting the number of people entering and leaving a room, thereby helping to avoid overcrowding and reduce unnecessary power consumption in places such as homes, seminar halls, and institutions. The system is built around the AT89S52 microcontroller, which acts as the core component and enables fast, reliable, and dynamic control of all operations. In today's busy lifestyle, lights are often left ON even when not required, leading to energy wastage; this system provides an efficient solution to that problem. The design incorporates two pairs of infrared (IR) transmitter–receiver sensors placed at entry and exit points, where the first sensor detects entry and sends a signal to the microcontroller to increment the count and switch ON the light, while the second sensor detects exit, decrements the count, and turns OFF the light when the count reaches zero. Additionally, a seven-segment display is used to show the current number of occupants in the room, making the system a practical, cost-effective, and energy-efficient solution for intelligent lighting and occupancy management.

I. INTRODUCTION

With the increasing demand for automation in modern infrastructure, there is a growing need for intelligent systems that enhance convenience, reduce energy consumption, and improve safety. In today's fast-paced world, manual control of electrical appliances, especially lighting systems, often leads to inefficiencies such as unnecessary power consumption and lack of monitoring of space utilization. This paper presents an automated room light control system integrated with a bidirectional visitor counter, designed to address these challenges in an effective and economical manner. The system automatically switches lights ON or OFF based on room occupancy while maintaining a real-time count of people present inside the room. This not only improves user convenience but also significantly contributes to energy conservation. Furthermore, by continuously tracking the number of occupants, the system helps prevent overcrowding and ensures better space management in environments such as classrooms, auditoriums, offices, and public halls, thereby enhancing both operational efficiency and safety standards.

II. SYSTEM OVERVIEW

The proposed system utilizes infrared (IR) sensors in combination with a microcontroller to accurately detect the entry and exit of individuals in a controlled space. Two sets of IR transmitter–receiver pairs are strategically placed at the entrance and exit points to monitor movement direction. When a person interrupts the IR beam at the entry point, the system interprets it as an incoming movement and increments the visitor count, while an interruption at the exit point results in decrementing the count. The microcontroller processes these inputs in real time and accordingly controls the lighting system, ensuring that lights are switched ON when at least one person is present and turned OFF when the room becomes empty. Additionally, the system provides a visual representation of the occupancy count using a display unit, enabling easy monitoring. This integration of sensing, processing, and control mechanisms makes the system reliable, efficient, and suitable for various real-world applications requiring automation and energy optimization.

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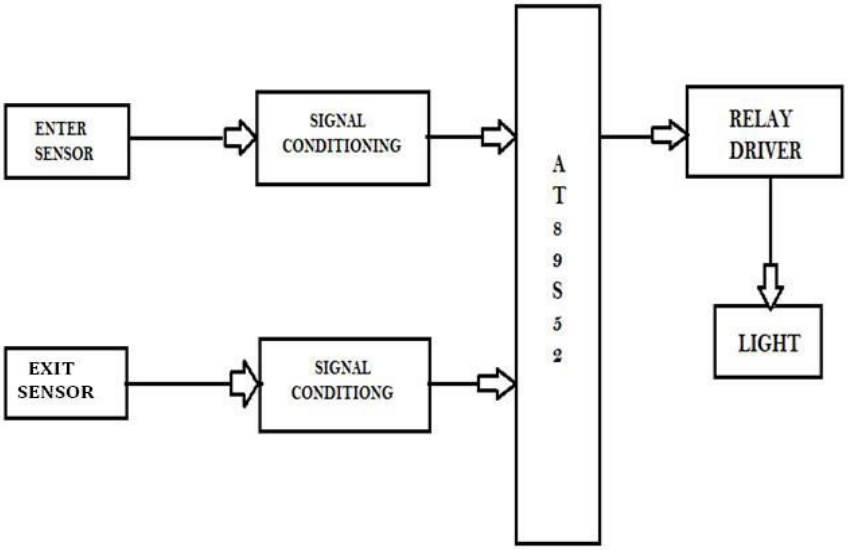
Table 1: Key Functional Features

Feature	Description
Automatic Lighting	Lights turn ON/OFF based on occupancy
Visitor Counting	Tracks number of people in the room
Energy Efficiency	Reduces unnecessary power consumption
Display	Shows count using 7-segment display

III. SYSTEM ARCHITECTURE

3.1 Block Diagram



The system consists of the following major components:

- Power Supply Unit
- IR Sensor (Entry & Exit)
- Microcontroller (AT89S52)
- Relay Driver Circuit
- Display Unit

3.2 Block Description

- **Power Supply:** Provides regulated +5V and +12V using IC 7805
- **Sensors:** Detect interruption using IR beams
- **Microcontroller:** Processes signals and controls logic
- **Relay Driver:** Controls switching of electrical load
- **Display:** Shows visitor count

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IV. CIRCUIT DESIGN

4.1 Transmission Circuit

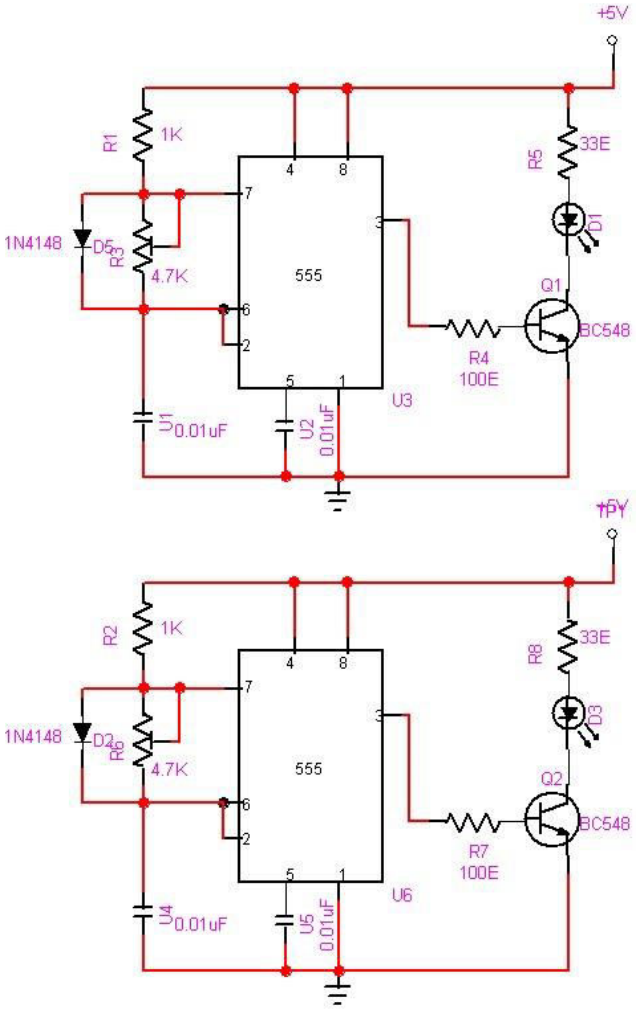

Figure 2: IR Transmitter Circuit

The transmitter uses a 555 timer in astable mode to generate a 38 kHz IR signal.

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4.2 Receiver Circuit

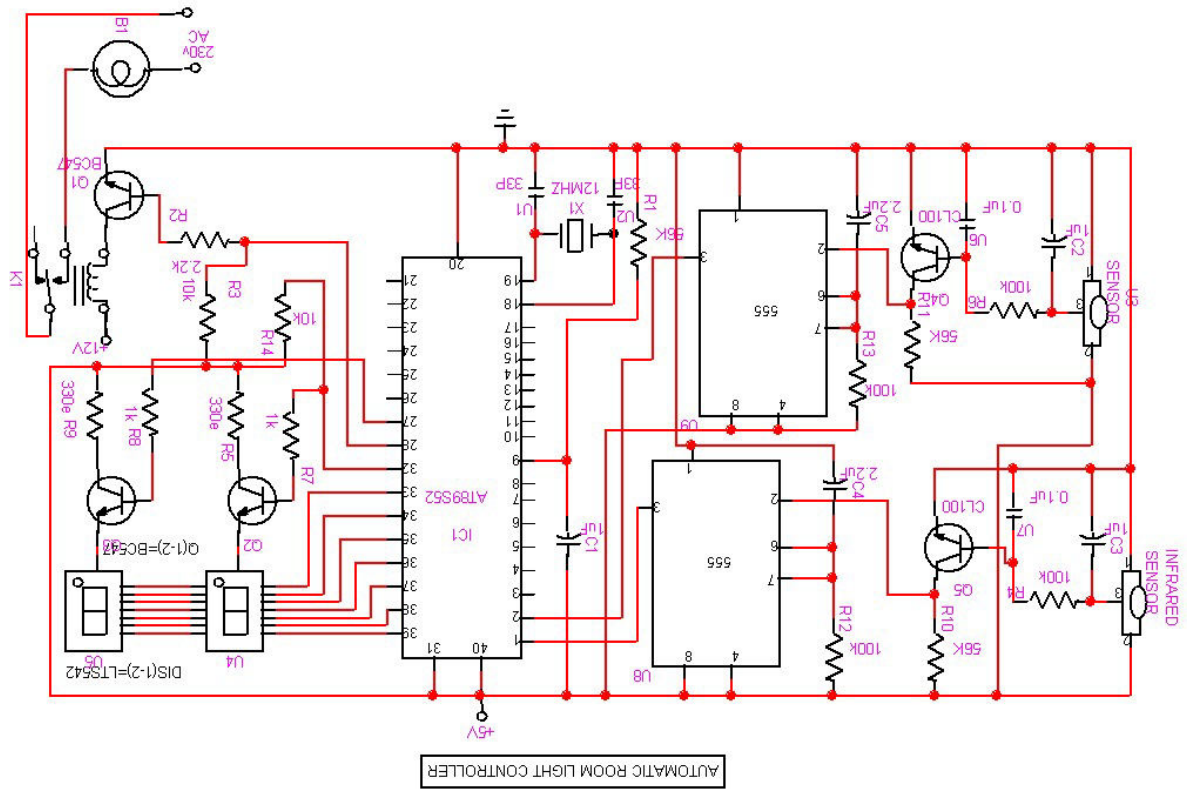

Figure 3: IR Receiver Circuit

The receiver (TSOP1738) detects IR signals. When interrupted, it sends signals to the microcontroller for processing.

V. COMPONENTS DESCRIPTION

Table 2: Major Components Used

Component	Description
AT89S52	8-bit microcontroller
TSOP1738	IR receiver sensor
IC 555	Timer for signal generation
LM7805	Voltage regulator
Relay	Controls electrical load
7-Segment Display	Displays count

5.1 Microcontroller (AT89S52)

- 8KB Flash Memory
- 32 I/O Pins
- Low power consumption

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5.2 Infrared Sensor (TSOP1738)

- High sensitivity
- Low power consumption
- Noise immunity

5.3 Timer IC (555)

- Generates stable frequency
- Used in astable mode

VI. WORKING PRINCIPLE

The system operates based on bidirectional sensing:

- If **Sensor 1 → Sensor 2**, count increments (Entry)
- If **Sensor 2 → Sensor 1**, count decrements (Exit)

When count > 0 → Light ON
When count = 0 → Light OFF

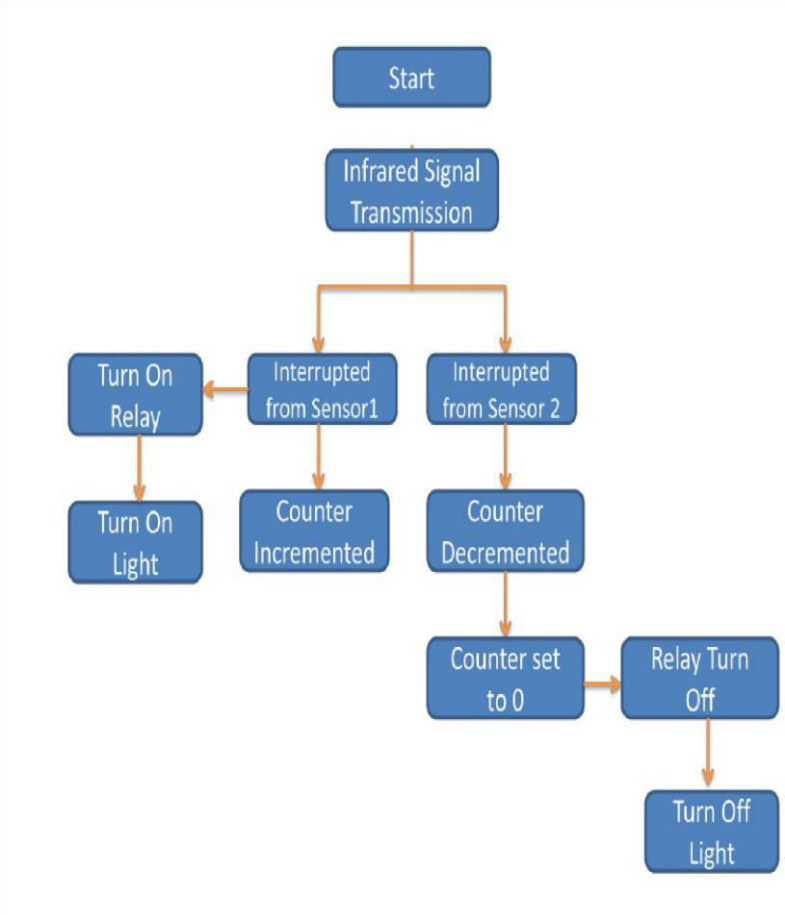

Figure 4: Flowchart of System Operation

VII. RESULTS AND DISCUSSION

The system successfully:

- Counts visitors accurately
- Automates lighting efficiently
- Reduces power wastage

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Table 3: Performance Analysis

Parameter	Observation
Accuracy	High (single person detection)
Power Saving	Significant
Response Time	Fast

Applications

- Smart homes
- Classrooms and auditoriums
- Offices and meeting rooms
- Public halls

Advantages and Limitations

Advantages

- Low cost
- Easy implementation
- Energy efficient

Limitations

- Cannot detect multiple people simultaneously
- Limited to single entry/exit point

Future Scope

- Integration with IoT systems
- Mobile app-based monitoring
- Smart HVAC integration
- Multi-door support

VIII. CONCLUSION

The proposed system demonstrates an effective and economical solution for automated lighting and visitor counting. It enhances energy efficiency and provides a foundation for smart building systems.

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