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Development of Automatic Lighting and Visitor Counter

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Abstract:
In today's world, energy efficiency is becoming a key concern. This paper presents a practical embedded system designed to automatically control lighting in a room and count the number of visitors using infrared (IR) sensors. The system switches the lights on when someone enters the room and off when the room becomes empty, helping conserve electricity. A microcontroller is used to process sensor data and maintain an accurate count. The project is cost-effective, easy to implement, and suitable for various real-life applications such as classrooms, libraries, and offices.

Keywords: Embedded system, visitor counter, IR sensor, microcontroller, automatic lighting, energy efficiency.

1. Introduction

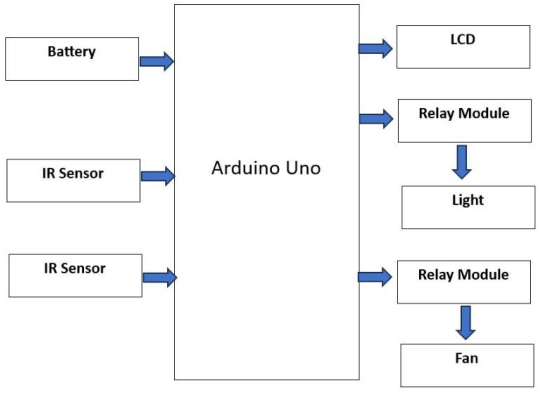
In modern buildings, especially those with high traffic, people often forget to switch off lights, resulting in unnecessary energy consumption. To solve this issue, automation can be introduced using an embedded system that turns lights on and off based on human presence. This project focuses on creating a low-cost system that uses sensors and a microcontroller to manage lighting and count the number of people in a room.

2. Literature Review:

Several systems have been proposed in the past to manage energy through automation. Some designs use motion sensors like PIR sensors, while others rely on image processing. However, many such systems are either expensive or complex. IR sensor-based systems offer a simple and reliable solution for detecting entry and exit events. The use of microcontrollers like Arduino or 8051 further simplifies the design and implementation.

3. System Design and Components

Block diagram of the automatic and lighting and visitor counter



3.1 Hardware Components

- **IR Sensors:** Used to detect motion at the entrance and exit.
- **Arduino UNO**: ATmega328P (used in Arduino UNO) is used to process signals and control outputs.
- **Relay Module:** Controls the switching of lights.
- **LCD Display:** Shows the number of people currently in the room.0

- **Power Supply:** 5V regulated supply for sensors and controller
- **USB Cable:** it is used to connect the power supply to laptop to Arduino uno.

3.2 Working Principle

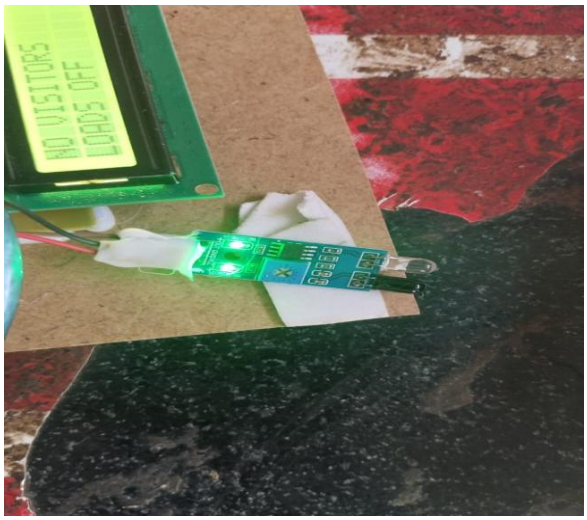
Two IR sensors are placed at the doorway. When Sensor 1 triggers before Sensor 2, it indicates entry; if Sensor 2 triggers before Sensor 1, it indicates exit. The microcontroller updates the counter and controls the light accordingly. If the count is more than zero, the light remains on. If zero, the light turns off.

4. Implementation

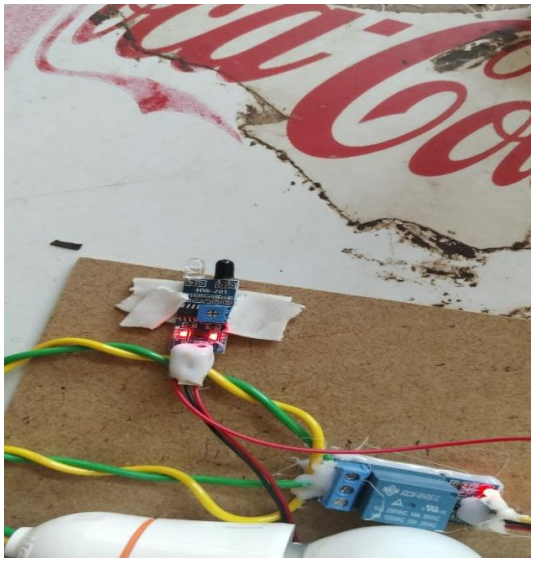
The system was implemented using an Arduino UNO board. The IR sensors were aligned carefully to detect directional movement. The counter logic was written in embedded C and uploaded to the board using Arduino IDE. A relay controlled the light bulb based on the counter value.

5. Results and Discussion

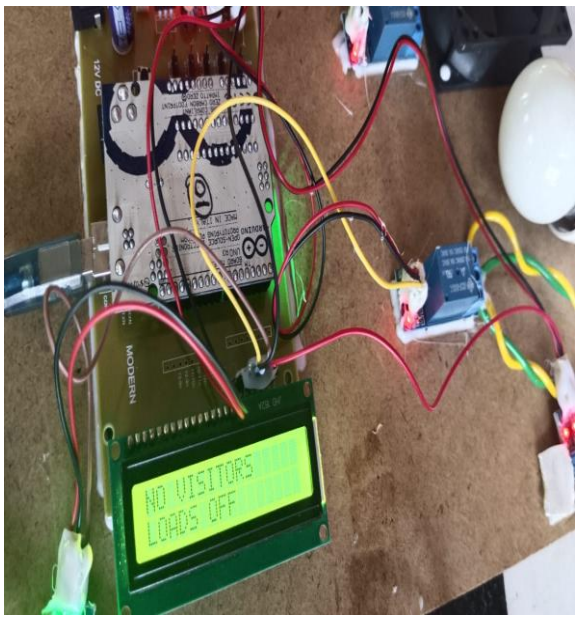
When people enter places like classrooms, function halls, colleges, D-Mart, or auditoriums, the automatic lighting and visitor counter system detects human entry and counts the number of people inside. An LED display shows the current number of people present in the room.



Transmitter section



Receiver section



Output of the automatic lighting and visitor counter

6. Applications

- Automatic lighting for classrooms, labs, offices
- Visitor tracking in exhibitions or events
- Energy saving in smart buildings

7. Conclusion

The proposed system demonstrates a simple and efficient way to automate lighting using an embedded

system. It reduces energy wastage and adds convenience without requiring manual operation. The project is scalable and can be enhanced further with wireless communication or IoT features.

8. Future scope

In the future, the system can be connected to a mobile app or cloud dashboard to log visitor data. It can also integrate with other smart devices like fans and ACs for complete automation. It is used to detected to how many peoples are entering the rooms or house or colleges.

9. References

1. **R. Agarwal and P. Sharma (2017)** *Design of Automatic Room Light Controller with Visitor Counter Using Arduino*
They identified a way to use IR sensors and Arduino to automatically control room lighting and count the number of people entering and leaving a space. The system turns off the light when the room is empty to save energy.

2. **S. Patil and A. Kulkarni (2016)** *Visitor Counting and Smart Light System for Public Spaces*
This research focused on using IR modules with microcontrollers in environments like libraries and auditoriums. The authors demonstrated a working system that displays real-time people count and manages lights automatically.

3. **M. Venkatesh and K. Rao (2019)** *Energy Efficient Lighting Automation Based on Human Detection*
They developed a system for public halls where IR sensors detect people and manage lights accordingly. The counter tracks people for capacity monitoring and is shown on an LCD

4. **D. Menon and K. Ravi (2018)** *IR Sensor Based Automation for Classrooms and Halls*
This study used dual IR sensors to distinguish entry and exit, controlling lights and showing the count on an LED screen. They also identified that such systems reduce manual switching and power waste.

5. **Rajkamal (2011)** *Embedded Systems: Architecture, Programming and Design*, Tata McGraw-Hill
A widely used textbook that explains microcontroller architecture, embedded programming, and real-time applications. It gives solid background for designing automation systems using hardware and software integration.