WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

EchoLamp – Sound Activated Smart Lighting

Sayali S .Yadav[a], Snehal S. Chavan[b], Mahek R.Mulani[c],Ajinkya B Patil[d]

[abc]student,NMCOE Peth,India

[d]Asst. Professor,NMCOE Peth,India

ABSTRACT :

This endeavor offers an automated smart lamp with clap control which aims to offer simple convenient illumination management. the controlled operation makes use of a sound sensor to sense claps and the control circuit to turn ON/OFF the smart bulb. the proposed automation will save manual intervention for switch, provides user conveniences and saves wastage of electricity, the whole setup is Low-Cost, Ease in operation and use for indoors application, home, school class room, office etc. it is used to understand of the concept of automation and IoT in lighting system which enables to save energy

Keywords: Smart Lamp, Clap Control, Automation, Sound Sensor, Energy Efficiency, Smart lighting

I.INTRODUCTION

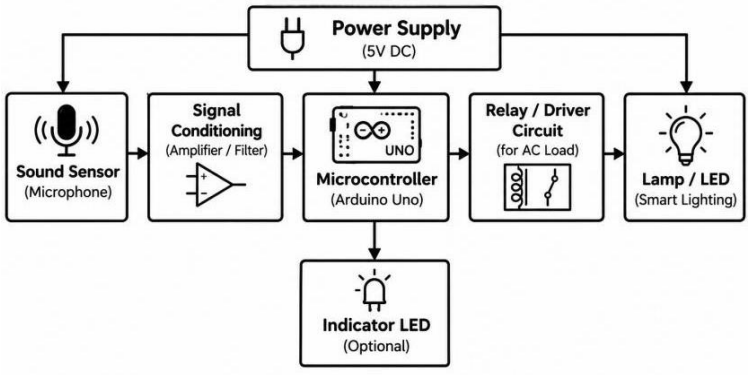
EchoLamp – Sound Activated Smart Lighting is an innovative and user-friendly lighting system designed to control a lamp using sound or clapping. In today's modern world, automation plays an important role in making our daily lives easier, more comfortable, and more energy-efficient. Traditional lighting systems require manual operation using switches, but EchoLamp provides a simple alternative by allowing users to control the light through sound. This project uses a sound sensor to detect sound signals, such as a clap, and sends the detected signal to a control circuit or microcontroller. The circuit processes the signal and switches the lamp ON or OFF according to the designed operation. EchoLamp can be useful in homes, bedrooms, offices, classrooms, and other places where convenient lighting control is required. It is especially helpful when a person cannot easily reach a switch or when operation hands-free is preferred. This project demonstrates the practical application of electronics, sound detection, and automation in everyday life. It is designed to be simple, economical, and easy to understand, making it suitable for engineering students and beginners in electronics. Furthermore, the system can be improved in the future by adding features such as voice control, mobile application control, smart home integration, and energy monitoring. Thus, EchoLamp is a smart and practical project that combines sound technology with automatic lighting control to provide convenience and support the efficient use of electrical energy.

LITERATURE REVIEW

Several researchers have studied smart lighting systems to improve convenience, automation, and energy efficiency in homes and workplaces. Traditional lighting systems require manual switching, whereas automated lighting systems use sensors and electronic circuits to control lights according to specific conditions. Previous studies on sound-activated lighting systems have demonstrated that a sound sensor can detect sounds such as clapping and convert them into electrical signals. These signals are processed by a control circuit or microcontroller to switch a lamp ON or OFF. Some researchers have also developed smart lighting systems using Arduino boards, voice recognition, and Internet of Things (IoT) technology to provide advanced lighting control. These systems reduce the need for manual operation and make lighting more convenient for users. However, some existing systems require additional components, complex programming, or higher implementation costs. Based on these studies, the EchoLamp – Sound Activated Smart Lighting project focuses on developing a simple, economical, and user-friendly lighting system that operates through sound detection. The project aims to demonstrate how sound sensors and electronic control circuits can be used to achieve automatic lighting control and provide a foundation for future smart home applications.t etc.

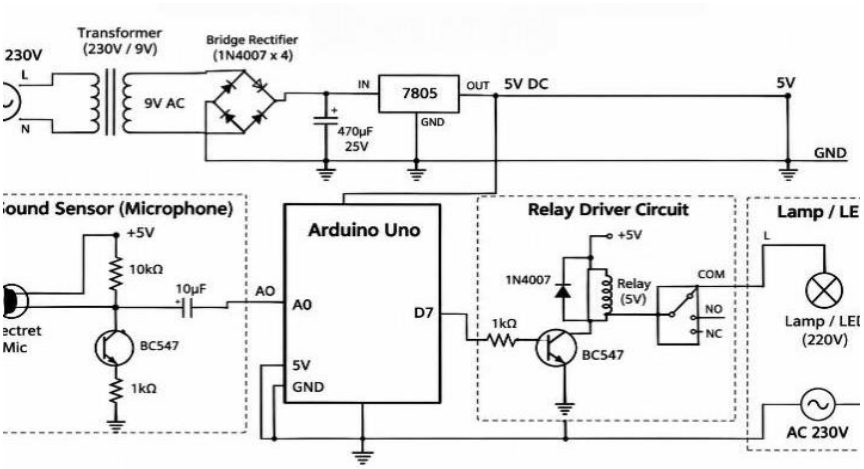
METHODOLOGY

BLOCK DIAGRAM



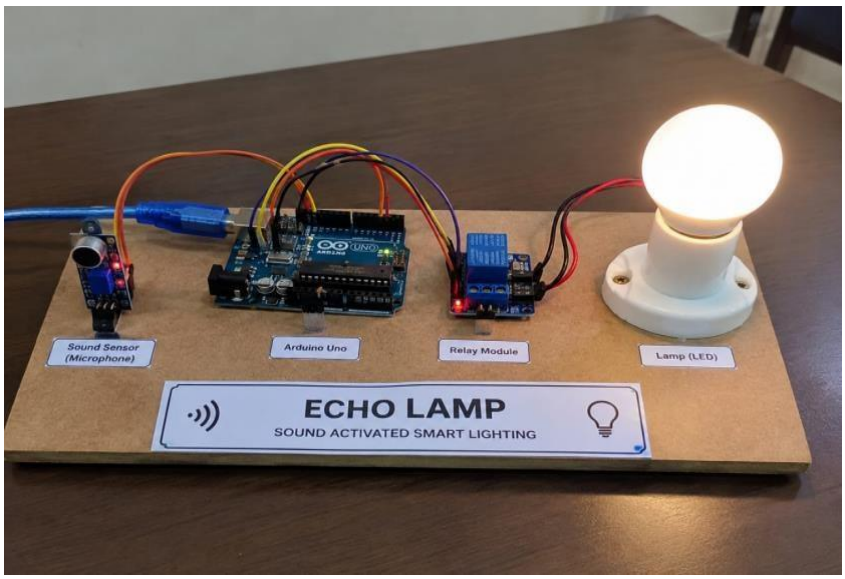
Sound Activated Smart Lighting project represents the working of a sound-controlled lighting system. The system consists of a power supply, sound sensor, signal conditioning circuit, microcontroller (Arduino Uno), relay or driver circuit, lamp/LED, and an optional indicator LED. The 5V DC power supply provides the required electrical power to the electronic components of the system. The sound sensor (microphone) detects sound signals, such as a clap, and converts them into electrical signals. These signals are passed to the signal conditioning circuit, which amplifies and filters the signals to make them suitable for processing. The conditioned signal is then sent to the microcontroller (Arduino Uno), which processes the signal according to the programmed instructions. When the detected sound meets the set conditions, the Arduino sends a control signal to the relay or driver circuit. The relay or driver circuit acts as a switching device and controls the lamp according to the system design. As a result, the lamp/LED switches ON or OFF in response to the sound signal. An optional indicator LED is connected to the microcontroller to indicate the operating status of the system. Thus, EchoLamp provides a simple, convenient, and automated method of controlling lighting through sound, reducing the need for manual switching.

CIRCUIT DIAGRAM



The EchoLamp – Sound Activated Smart Lighting circuit works by detecting sound and automatically controlling a lamp using an Arduino Uno. First, the power supply circuit converts the 230V AC supply into 9V AC through a step-down transformer. The bridge rectifier, consisting of four 1N4007 diodes, converts AC into pulsating DC. A 470µF capacitor filters the DC voltage, and the 7805 voltage regulator provides a regulated 5V DC supply to the Arduino and other electronic components. The sound sensor circuit uses an electret microphone to detect sound, such as a clap, and converts it into an electrical signal. The BC547 transistor amplifies the weak signal, and the capacitor couples the signal to the analog input (A0) of the Arduino Uno. The Arduino processes the input signal according to the program and, when the sound meets the programmed conditions, sends a control signal through digital pin D7. This signal passes through a 1kΩ resistor to the BC547 transistor in the relay driver circuit, which switches the 5V relay ON or OFF. A 1N4007 diode connected across the relay coil protects the transistor from voltage spikes generated when the relay switches off. The relay contacts then control the 230V AC lamp, switching it ON or OFF according to the circuit design. Thus, the EchoLamp system provides convenient sound-based lighting control without requiring the user to operate a conventional switch manually.

RESULT



COMPONENT DETAILS

1. SOUND SENSOR

The sound sensor is the input component of the EchoLamp system. It detects sound signals such as clapping and converts them into electrical signals. When a person claps near the sensor, it detects the sound and sends a signal to the Arduino Uno for further processing. The sensitivity of the sensor determines how effectively it detects sound. Thus, the sound sensor acts as the main input device of the project.

2. ARDUINO UNO (MICROCONTROLLER)

The Arduino Uno is the main controlling unit of the EchoLamp system. It receives the electrical signal from the sound sensor and processes it according to the programstored in its memory. When the detected sound satisfies the programmed conditions, the Arduino sends a control signal to the relay module. It controls the switching operation of the lamp and helps the system operate automatically. Thus, the Arduino Uno acts as the brain of the project.

3. RELAY MODULE

The relay module is the switching component of the EchoLamp system. It receives a control signal from the Arduino Uno and switches the lamp ON or OFF. It allows a low-voltage control circuit to operate a separately powered lamp through suitable electrical isolation. When the Arduino sends the required signal, the relay changes its contact position and controls the lamp according to the programmed operation. Thus, the relay module helps control the lighting system automatically without using a manual switch.

FUTURE SCOPE

The future scope of the EchoLamp – Sound Activated Smart Lighting project is very promising because it can be further developed using advanced automation technologies. In the future, the system can be integrated with voice control, mobile applications, and Internet of Things (IoT) technology to allow users to control lights remotely. Artificial intelligence can be used to distinguish clapping from other sounds and reduce unwanted switching. Additional features such as adjustable sound sensitivity, automatic brightness control, motion detection, and energy monitoring can also be included. The system can be expanded for use in homes, offices, classrooms, hospitals, and smart buildings. With further improvements in design and energy-efficient lighting, EchoLamp can become a more reliable, convenient, and cost-effective smart lighting solution.

CONCLUSION

The EchoLamp – Sound Activated Smart Lighting project demonstrates a simple and effective method of controlling a lamp using sound signals such as clapping. The system uses a sound sensor to detect sound, an Arduino Uno to process the signal, and a relay module to control the lamp. It reduces the need for manual switching and provides greater convenience for users. The project also helps students understand the practical applications of sensors, microcontrollers, electronic circuits, and automation. It is economical, easy to understand, and suitable for basic smart home applications. Overall, EchoLamp demonstrates how simple electronic components can be combined to develop an innovative lighting system that supports convenient operation and the efficient use of electrical energy

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