WWW.IJRPR.COM

International Journal of Research Publication and Reviews

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

Building an IR-Bsed Switch: A Low-Cost Remote Control Solution for Automation

Dr. Shailaja Patil[1], Yogesh K. Kirange[2], Sonavane Nikhilesh Manohar[*], Patil Yadnesh Vaman[3], Patil Harshali Sarjerao[4], Dabhade Sakshi Sanajay[5], Avhad Om Nitin[6]

[1]Associate Professor, Department of Electrical Engineering, R. C. Patel Institute of Technology, Shirpur, Maharashtra, India
[2]Assistant Professor, Department of Electrical Engineering, R. C. Patel Institute of Technology, Shirpur, Maharashtra, India
[,3,4,5,6] UG Student, Department of Electrical Engineering, R. C. Patel Institute of Technology, Shirpur, Maharashtra, India*

A B S T R A C T

This paper present a wireless switch board for easy access in various places like school, home, college and old-age home's for operating electrical appliances like Tube-light, fan, etc. Without interference from similar wireless switches in adjacent rooms. The data signal is transferred to receiver wirelessly by Remote Control and Mobile phones. The receiver used is TSOP 1738, to read data signal operating at 38 kHz and a IC4017 to communicate trigger signal and process data to turn the on/off the switch. The remote uses an infrared light-emitting diode to transmit a signal, which is then decoded by a receiver. The receiver activates only when this signal is received. This innovation can succeed if people are informed about its benefits and user-friendly features. The circuit can also be employed to adjust the brightness of lights. It is particularly useful for elderly individuals who prefer not to walk to control the fan speed, or for anyone wishing to adjust the speed while lying in bed. The control settings and output AC voltage of the fan regulator have been analyzed.

Keywords: IC4017, TSOP1738, Remote.

Introduction

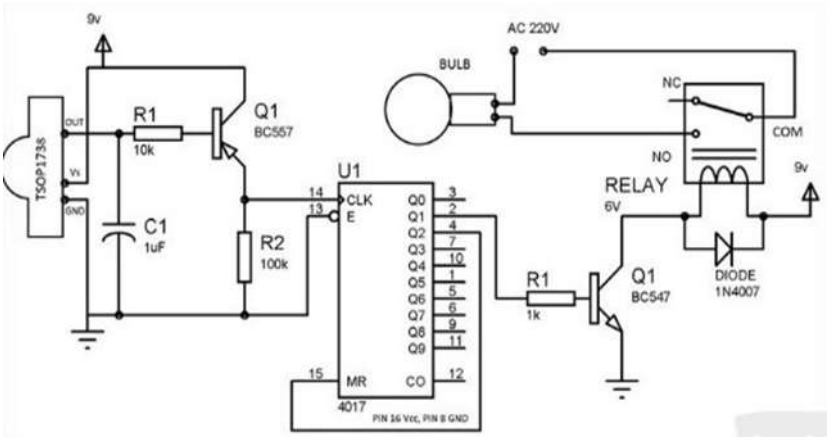
The Remote-Controlled Switch allows you to control the operation of home appliances via a standard remote control. This system is capable of switching on or off up to s required electrical devices. All functions are managed by an IC4017, which receives and decodes infrared signals from the remote control to switch the appropriate device on or off. The system operates within a range of up to 10 meters and can handle devices with a maximum load current of 5 amperes. For high-power devices, relays can be upgraded to handle the load. In the event of a power failure, the devices will return to their previous state once power is restored.

The IC4017 processes the infrared signals from the transmitter, and based on the decoded information, it switches the corresponding device accordingly. The system can be controlled using any remote control or can be controlled by the mobile. The remote sends a series of bits (0's and 1's) modulated with a 38 kHz infrared signal, following the IC4017.

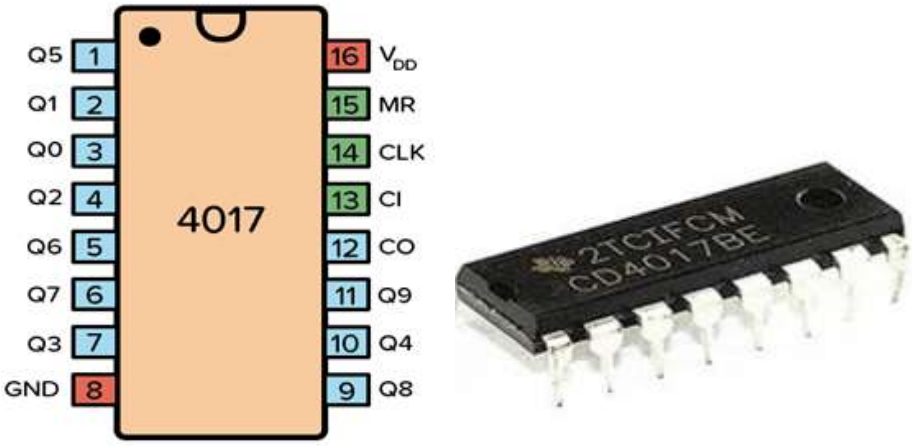
The Time Operated Power Saving Electrical Appliance Control System is a reliable solution that automates the on/off function of devices based on a set time schedule. This system eliminates the need for manual switching, featuring a built-in real-time clock to track the current time. When the set time matches the programmed schedule, the corresponding relay activates the connected device. The time settings can be adjusted at any point using the keypad.

Additionally, the PC parallel port serves as an efficient yet powerful platform for controlling real-world devices. Through an interface circuit, the computer program controls the relays, which in turn manage the switching of household appliances and other electrical devices.

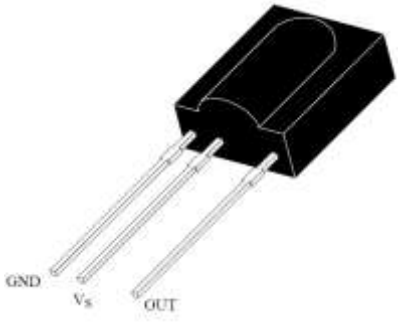
CIRCUIT DIAGRAM AND COMPONENTS



An IR Remote Switch Circuit Diagram allows you to wirelessly control electrical devices using an infrared remote control. The circuit typically includes an infrared receiver module (such as TSOP1738) that captures the IR signals sent by a compatible remote control. When a button on the remote is pressed, it transmits a specific 38 kHz modulated signal to the receiver. The TSOP1378 decodes this signal, identifying which button was pressed, and accordingly activates or deactivates connected relays. These relays act as switches, controlling the power to devices connected to them, allowing for on/off operations. The circuit may include diodes to protect against reverse current, transistors to drive the relay, and capacitors to stabilize the power supply. The IR range is usually around 10 meters, depending on the strength of the remote and IR receiver sensitivity. This setup is commonly used for controlling home appliances remotely and can support multiple devices by mapping each remote button to a specific relay channel.



The IC 4017 is a decade counter/divider IC commonly used in IR remote switch circuits for controlling multiple devices. In an IR remote switch circuit, the IC 4017 receives pulses from the infrared receiver, which detects the signal sent by the remote control. When a specific button on the remote is pressed, the IR receiver module (such as TSOP1738) sends a pulse to the clock input of the 4017 IC. This pulse causes the IC 4017 to increment its count and activate one of its 10 output pins sequentially. Each output pin can be connected to a relay to control a different appliance or device, allowing users to switch multiple devices on or off with each press.



The TSOP1738 is a key component in IR remote switch circuits, acting as the infrared receiver that captures signals sent by an IR remote control. Operating at a 38 kHz carrier frequency, the TSOP1738 is specifically tuned to receive IR pulses modulated at this frequency, making it ideal for use with standard remote controls. When an IR remote sends a signal, the TSOP1738 detects the 38 kHz modulated beam and converts it into a series of electrical pulses that represent the encoded signal.

In an IR Remote Switch, the relay plays a crucial role by acting as an electrically operated switch that controls the connected appliances. When an infrared signal from a remote control is received and processed by the circuit's microcontroller or decoder module, it triggers the relay to either open or close its contacts, thereby turning the connected appliance on or off. The relay is typically powered through a transistor driver, which amplifies the control signal from the microcontroller to handle the relay's coil current.

Literature Review

The advancement of IR remote switch systems has greatly simplified the control of household and commercial electrical devices by using infrared technology for wireless switching. These systems employ standard IR protocols, like the RC5 protocol, enabling users to manage appliances such as lights, fans, and smaller devices from distances of up to 10 meters. The IR remote transmits a modulated infrared signal containing binary data, which a receiver circuit connected to the switch decodes. This decoded signal instructs the switching unit to turn appliances on or off, making the technology compatible with a wide range of household IR remotes.

The use of IR remote switching has also boosted energy efficiency and convenience, particularly in smart home setups and power management solutions. Many advanced IR switch systems feature time-based control options, allowing appliances to be turned on or off at scheduled intervals to reduce standby power use and optimize appliance operation. This approach supports energy conservation by automatically turning off devices when they are not needed, minimizing the chances of accidentally leaving appliances on. Additionally, the use of relays in these systems enables safe control of high-power devices by isolating the control circuit from the main power source, enhancing both safety and reliability.

Problem Statement

In recent years, the growing demand for more convenient and efficient control systems has increased interest in infrared (IR) remote-controlled switches for applications in home automation, industrial operations, and consumer electronics. Traditional mechanical switches require users to be physically present to operate them, which limits their usability and reach. IR technology, on the other hand, provides a straightforward and cost-effective method for remote operation, allowing users to control devices from a distance without physical contact.

Methodology

The IR Remote Switch system allows users to remotely operate household appliances using infrared signals. With a standard IR remote, users can control up to required appliances, switching them on or off from up to 10 meters away. The system's core component is an IC4017 and TSOP1738 combined with some resister and capacitors, which receives and interprets infrared signals from a receiver module. These signals, formatted as a sequence of bits based on the transmitter and receiver phenomenon, are decoded to determine the specific appliance to activate or deactivate, enabling precise control over each device.

After decoding the signal, the microcontroller activates a relay linked to the selected appliance, allowing current to pass through and either power the device on or off. The relays are configured to support loads of up to 5 amperes, with options for handling higher loads by upgrading the relays as needed. Additionally, the system is designed to remember device states following a power outage, ensuring appliances resume their previous status. To maximize compatibility, the system works with any remote or mobile phone, making it versatile for use with remotes transmitting 38 kHz modulated IR signals.

Limitations

An IR (Infrared) remote switch system, while widely used and convenient, faces several inherent limitations. A significant drawback is its reliance on line-of-sight communication, which requires an unobstructed path between the remote and the receiver. Any obstacles, like walls, furniture, or even people, can block the signal, reducing its effectiveness and generally restricting its operation to a single room. The range of IR systems is also limited, typically around 5-10 meters, depending on the transmitter's strength and the receiver's sensitivity. This constraint prevents the user from controlling

devices over longer distances or across multiple rooms, unlike systems using RF (radio frequency) or Wi-Fi, which provide broader coverage and flexibility.

IR remote switches are also prone to interference from other IR-emitting sources, such as sunlight, fluorescent lighting, or other nearby IR devices like televisions or air conditioners. This interference can lead to false triggers or unreliable signal transmission, particularly in environments with multiple IR devices. Additionally, IR technology only supports one-way communication, meaning the remote cannot confirm if the device has successfully received or executed a command. This lack of feedback can pose challenges in situations where reliable control is essential, as users may be unaware if an instruction has been missed. Despite their simplicity and popularity, IR remote switches are limited by issues of range, interference, and lack of responsiveness, making them less suitable for more complex or multi-room control systems.

Results

An IR Remote Switch is a system that enables users to control home appliances remotely through infrared (IR) signals. This system allows switching on and off of multiple electrical devices by using a standard IR remote. At the core of the setup is an IC4017 and TSOP1738, which receives IR signals, decodes them, and triggers the corresponding relay to control the connected device. It operates within a range of up to 10 meters and can handle appliances with a maximum load of 5 amperes. For high-power appliances, upgrading the relay allows for safe operation. The system returns devices to their previous state following a power failure, ensuring reliable functionality.

The IR remote operates on the RC5 protocol, sending a sequence of modulated bits that the microcontroller processes to switch devices as directed. This automation replaces the need for manual operation, making it more convenient and energy-efficient. For advanced functionality, a Power Saving Time Operated feature can automate switching based on real-time scheduling. This scheduling is adjusted easily via an integrated keypad, while a real-time clock ensures precise control. Together, these components form a practical solution for remote and timed control of household appliances.

Conclusion

The completion of our project, "Remote Controlling of Home Appliances," marks a practical demonstration of using components like the IC4017 and TSOP1738 to wirelessly manage various appliances. This project showcases how these components work together to control devices with an everyday IR remote, making it versatile for use in both residential and commercial spaces. The IC4017, a popular decade counter, plays a key role by counting pulses from the TSOP1738 IR receiver, allowing specific devices to be toggled on or off as per the signal received from the remote. The TSOP1738, a standard infrared receiver, is tuned to detect signals from typical IR remotes, converting these signals into electrical pulses that trigger the IC4017 to switch devices on or off. The design offers a streamlined and user-friendly solution that leverages commonly available technology, allowing users to control appliances without the need for additional complex equipment.

References

[1] Richard H.B.,Embedded C Programming and the Atmel AVR, Clifton Park, NY Thomson Delmar Learning, 2006.

[2] Pranav Kumar Asthana, Advances in Applied Science Research, 2010, 1 (2), pp. 84-91.

[3] Ahmed M. S., Mohammed A. S., Onimole T. G., Attah P. O., Leonardo Electronic Journal of Practices and Technologies,9,p.55-62, 2006.

[4] Kolo J. G., Daudad U.S., Leonardo Journal of Sciences, 7, p. 175-186 200.