GIET UNIVERSITY JOURNAL, 2025, VOL.4

Special Issue: Recent Advances in Electronics and Communication Engineering

PP: 136 - 142 ***ISSN: 2583-5955***

CONTACTLESS SWITCH FOR SMART HOMES

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Abstract: This paper outlines the procedure for crafting a simple and effective contactless switch for smart homes. Contactless switches are generally used to controlled the home appliances. Current technologies consist of various types of home automation methods, including Bluetooth-based, Wi-Fi-based, Voice recognition-based, etc. In addition to the currently accessible technologies in the area of home automation, gesture-based home automation has made big role in the current market. In the case of COVID-19 pandemic situation we are prohibited to touch anything so this contactless switch helps as to use the corresponding appliances to control. To prevent contracting covid-19, it is essential to refrain from touching buttons, keys, or switches that are often used by other people. In response to this, switching technology needs to be advanced so that a manual switch can be substituted with a contactless switch. A contactless switch is a modern technology that allows users to operate household devices like lights, fans, or televisions without physically touching the switch. Operation and management of contactless switches are done through hand gestures. We can also control these appliances through remote control also.

***Keywords*— Arduino Nano, APDS-9960 Gesture Sensor, 2-Channel Relay Module**

1. Introduction:

The increasing integration of technology into our daily lives has significantly impacted home automation systems. Traditional physical switches, while functional, present limitations in terms of convenience, hygiene, and accessibility [1]. The demand for improved user experience and enhanced safety features has driven the development of contactless switches for smart homes. These switches offer a variety of advantages,

including remote control capabilities, improved hygiene by eliminating the need for direct physical contact, and enhanced accessibility for individuals with mobility challenges. This literature review explores the diverse technological approaches employed in the design and implementation of contactless switches, analyzing their functionalities, advantages, limitations, and potential future developments. We will examine various technologies, including gesture recognition, GSM-based systems, and sensor-based approaches, while considering user needs, security concerns, and energy efficiency [2]. The review aims to provide a comprehensive overview of the current state of contactless switch technology in smart homes and Identify areas for future research. assembly provides invaluable data for regulating processes, ensuring safety measures, and optimizing overall system performance. The collective synergy of these components underscores their significance in creating a reliable and adaptable temperature sensing solution.[3]

2. Literature Review:

Gesture recognition has revolutionized human-computer interaction (HCI), enabling intuitive control over smart home appliances. By interpreting hand movements into actionable commands, systems like those developed by A. J, S. V, Rajini A. R, Meena P, Ramanathan M, and V. M make it possible to control devices such as lights and fans with a simple wave or gesture [1]. GSM (Global System for Mobile Communications)-based switches allow remote control of appliances using SMS or calls. These systems, reviewed by Ms.Shivanjali Nigade, Mr.Anurag Tayde, Ms. Tanvi Shinde, Prof.Rajeshwari Malekar typically include a GSM module, microcontroller, and relay components. They offer cost-effective solutions by leveraging existing cellular networks for communication [2]. Sindre Klavestad, G. Assres, Siri Fagernes, Tor-Morten Grnli. "Monitoring Activities of Daily Living Using UWB Radar Technology: A Contactless Approach." In recent years, the ultra-wideband (UWB) radar technology has shown great potential in monitoring activities of daily living (ADLs) for smart homes [3]. Addor, John, Adjardjah, Winfred, Opare, Wisdom, Otchere, Peter, "Design and Construction of Voice Controlled Smart Power Strip", Mohammad Nassar for Researches (MNFR), 2023 The technology behind contactless switches plays a pivotal role in the advancement of smart home systems,

significantly enhancing usability and efficiency. Utilizing technologies such as infrared sensing, capacitive touch, and voice activation, these switches eliminate the need for physical contact, thereby promoting sanitation and ease of use, particularly in response to public health concerns like the COVID-19 pandemic. Innovative systems incorporate voice control modules linked to power management units, allowing users to operate devices seamlessly through voice commands[4].SejalBagde,PratikshaAmbade,Manasvi Batho,Piyush Duragkar,Prathmesh Dahikar,Avinash Ikhar switch effectively integrates various technologies, enhancing home automation and user convenience through remote control via Wi-Fi. It highlights the potential for future advancements in smart home technology, emphasizing the importance of adopting innovative solutions for efficient energy management and improved living environments [5]. Abdullah S. Almansouri present an overview on the development of chip less RFID light switches by the authors introduces a passive, battery-free solution for smart homes, enhancing convenience and functionality. Their design integrates toggle switches with radio frequency spiral resonators, enabling effective communication of switch status without traditional power sources [6]. Muhammad Umair, Muhammad Aamir Cheema, Omer Cheema, Huan Li, Hua Lu present the impact of pandemic situation to prevent the impact of COVID-19 on IoT adoption has been explored across various sectors, highlighting both challenges and opportunities for technology integration[7]. Erik P. van Geest, Khosrow Shakouri, Wangyang Fu, Vincent Robert, Viorica Tudor, Sylvestre Bonnet, Grégory F. Schneider giving the idea of emphasizes the challenges of probing insulating molecular materials, the innovative use of graphene, and the introduction of chemo-electric gating as a promising method for contactless sensing, which could significantly impact future electronic device design[8].

3. Design and Implementation:

The design and implementation of a contactless switch for smart homes utilize the Arduino Nano, APDS-9960 Gesture Sensor, and a 2-Channel Relay Module to enable intuitive

GIET UNIVERSITY JOURNAL, 2025, VOL.4

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control of appliances without physical contact. The APDS-9960 sensor detects hand gestures, such as swipes, and sends the corresponding data to the Arduino Nano for processing. Depending on the gesture swipe up, down, left, or right, the Arduino controls the 2-Channel Relay Module to switch devices like lights or fans on or off. APDS-9960 Connect SDA and SCL pins to A4 and A5 of Arduino Nano, respectively. And VCC to 3.3V and GND to GND.In relay module IN1 and IN2 pins connect to D7 and D8 of the Arduino Nano. And VCC to 5V and GND to GND.

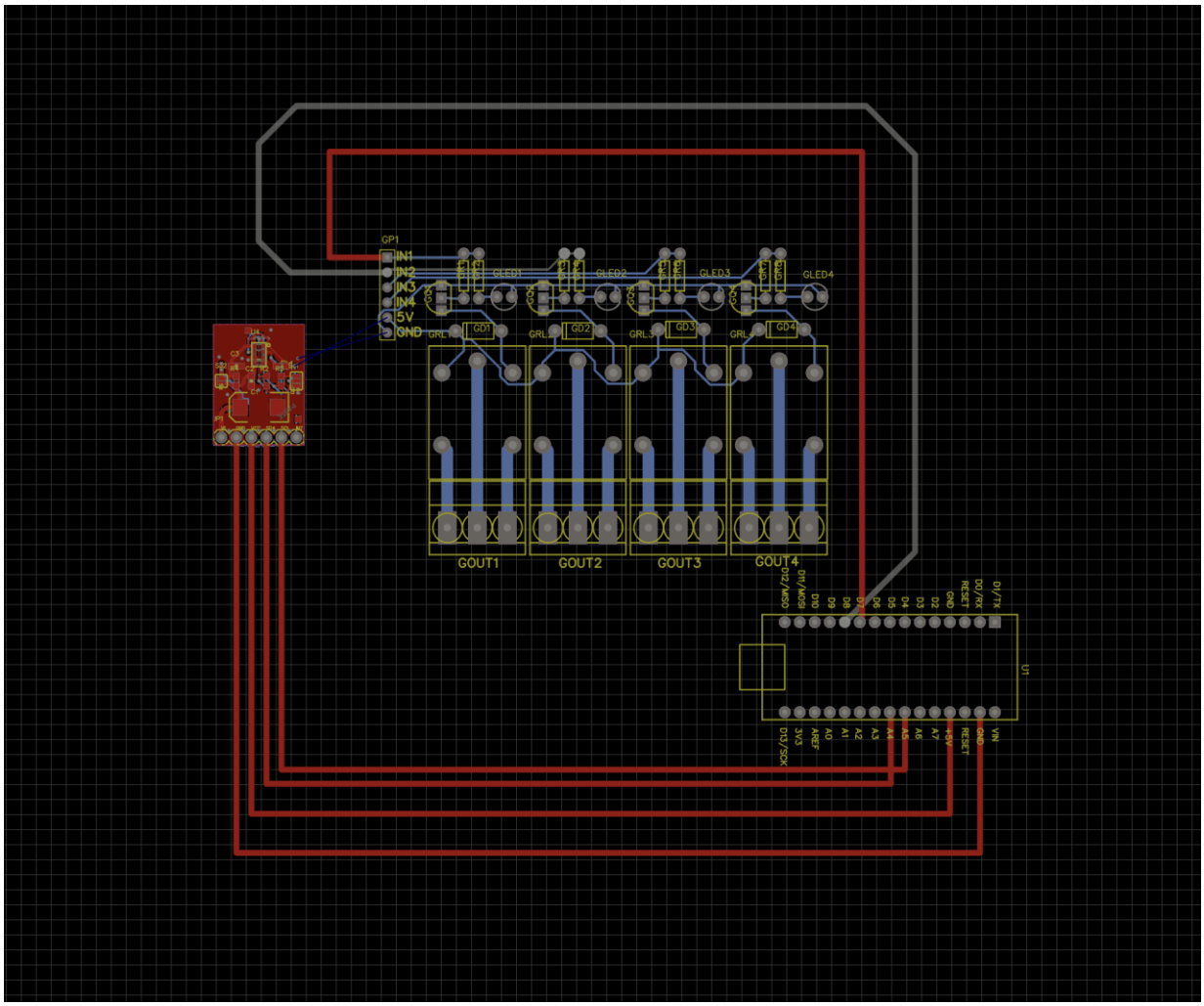

Figure 1 Connection of different part of circuit

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4. **Simulation Parameter:** To define various aspects that are relevant to the simulation process. These parameters are used in the device according to the result needed. The perfect combination of these parameters helps to achieving the desired result of the contactless switch to operate various appliances.

Table 1 Parameter of different devices

Component	Specification	Qty.
Arduino Nano	ATmega328P, 16MHz, 5V/3.3V	1
APDS-9960 Gesture Sensor	I2C Interface, 2.4V - 3.6V, Gesture Detection	1
2-Channel Relay Module	5V Trigger Voltage, 250V AC/10A	1
Breadboard	Standard size, 400 tie-points	1
Jumper Wires	Male-to-Male, Male-to-Female, 20cm length	--
Power Supply (Adapter)	5V, 1A USB Adapter	1
AC Bulb	220V, 40W (or as required)	1

5. Result Analysis:

Contactless switches for smart homes are an essential innovation, especially in the context of maintaining hygiene and safety. These switches eliminate the need for physical interaction using APDS-9960 Gesture sensor , making them ideal in environments where avoiding contact with surfaces is critical, such as during pandemics. There are various types of contactless switches, including those that rely on gesture recognition and proximity sensors. For instance, a gesture-controlled switch can detect hand movements, enabling the control of lights, fans, or other home appliances without physical touch. This technology typically uses infrared or capacitive sensors to interpret motion, providing seamless operation in a smart home ecosystem. Another approach uses sensors that detect the proximity of the user's hand, turning on or off appliances when a hand comes within

a certain range. Then the lights are on and off These systems are integrated into smart home platforms, allowing users to control devices remotely via a cloud or IoT-based interface. This means devices can be monitored and controlled from a smartphone or other connected devices, further enhancing convenience. Such switches provide both practicality and safety, enhancing user experience by offering comfort and minimizing contact with surfaces.

6. Conclusion:

In summary, the paper highlights the importance of contactless switches in smart homes, particularly in the context of the COVID-19 pandemic, where minimizing physical contact is crucial. By exploring various technologies such as gesture recognition and GSM-based systems, the research identifies the potential for enhanced user convenience, safety, and energy efficiency in home automation. The review also emphasizes the need for further research to address existing challenges and improve the functionality of contactless switches, ensuring they meet user needs and security concerns effectively.

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