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Smart Panel

Paritosh Chavan[1], Anirudha Sonawane[2], Sumedh Chavan[3], Shailesh Amane[4], Atharva Sarde[5]
Department of Instrumentation and Control, Vishwakarma Institute of Technology, Pune

Abstract: ***A smart switchboard provides convenience by allowing users to remotely control their electrical devices and appliances through a mobile application or web interface. It also offers energy efficiency by monitoring energy usage and promoting adjustments for lower consumption and bills. In this paper we developed a smart panel for wireless control of lights and appliances, including fan speed control, using the Blynk app. A system was also implemented to display and cut off power supply if current or voltage exceeded a set limit to prevent harm to the appliance. The project demonstrated successful implementation and improvement of basic appliance control and safety measures.***

Keywords: Blynk app, Current, Nodemcu, Relay

I. INTRODUCTION

Automated switchboards, also referred to as smart panels(Switchboards), have become increasingly popular due to their capability to remotely control and monitor various electrical appliances and devices. These switchboards utilize wireless communication technologies such as Wi-Fi, Bluetooth, and Zigbee, which enable users to control and monitor their electrical appliances from anywhere at any time, through a mobile app or web interface, offering them convenience and flexibility. Apart from convenience, automated switchboards offer added safety features by using sensors to detect changes in the environment, such as temperature, humidity, and motion, which can help prevent accidents or damages. For instance, if the temperature in a room exceeds a certain threshold, the switchboard can automatically turn on the air conditioning system to regulate the temperature. Moreover, automated switchboards offer energy-saving benefits by monitoring the usage patterns of various electrical appliances and identifying areas of high energy consumption. This information can be used to suggest ways to reduce energy usage, such as turning off lights and appliances automatically when not in use or optimizing the use of solar energy based on weather forecasts. Automated switchboards have a wide range of potential applications in various industries, such as homes, offices, hospitals, and factories. In the healthcare industry, for instance, these switchboards can monitor patients' vital signs and regulate the environment to provide optimal conditions for their recovery. Overall, this research paper will provide insights into the design and implementation of automated switchboards, the benefits they offer, and their potential applications in various industries, making it a valuable resource for researchers, engineers, and enthusiasts interested in the field of automation and smart technologies.

II. LITERATURE REVIEW

While designing the project many patents and research paper were studies some of which have been mentioned below

1) The paper provides a comprehensive overview of low voltage circuit breakers and their applications in industrial and commercial power systems. It covers the basic principles of circuit breakers, types of circuit breakers available for low voltage applications, components of a circuit breaker, circuit breaker selection and application, maintenance and testing procedures, and recommendations for proper selection and application of circuit breakers based on load type, fault current rating, and coordination within a power system. The paper is a useful resource for engineers and technicians involved in the design, installation, and maintenance of low voltage power systems.

2) The paper presents a solution for switching small inductive currents with high-voltage vacuum circuit breakers by addressing the challenges of inrush current that can cause damage to the circuit. The authors propose a new circuit breaker design that includes a damping circuit and a modified contact system in the vacuum interrupter to reduce the inrush current and improve current chopping performance. Experimental results show the effectiveness of the proposed design, which can improve the reliability and performance of power systems.

3) The paper proposes a new circuit breaker concept that integrates advanced sensing and communication technologies for enhanced system performance and protection. The smart circuit breaker design includes advanced sensing capabilities, wireless communication, and onboard processing capabilities. Potential benefits of the smart circuit breaker include improved power system protection, enhanced system monitoring and control, and increased system efficiency. Experimental results demonstrate the effectiveness of the smart circuit breaker concept in improving system performance and protection, making it a promising new concept for power systems.

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4) The paper presents a remote monitoring system for electrical equipment in a smart house system. The system includes sensors for monitoring electrical parameters, a microcontroller for data processing, and wireless communication. The authors discuss the benefits of the system, including improved safety, reliability, and energy efficiency. Experimental results show the system's effectiveness in detecting abnormal electrical behaviour and preventing potential safety hazards, making it a useful approach for remote monitoring of electrical equipment in smart house systems.

5) The paper presents a new control system for low voltage switchboards that uses a programmable logic controller (PLC) and human-machine interface (HMI) for improved control and monitoring. The authors discuss the limitations of traditional switchboard control systems and the need for an improved, more flexible system. They also present experimental results that demonstrate the effectiveness of the new control system in improving switchboard performance and flexibility. The paper provides a useful approach for the implementation of a new control system for low voltage switchboards, which can improve performance, flexibility, and monitoring capabilities.

6) The paper proposes a new decentralized monitoring and control system for smart appliances in homes using ZigBee wireless communication technology. The system includes small-world networking, where each smart appliance acts as a node in a network and can communicate directly with nearby nodes, as well as indirectly with more distant nodes through intermediary nodes. The benefits of the system include improved flexibility, reliability, and energy efficiency, as well as reduced complexity and cost compared to traditional centralized control systems. Experimental results demonstrate the effectiveness of the small-world networking approach in improving system performance and reducing energy consumption.

III. METHODOLOGY

The Project is divided into 3 phases

1) *Phase 1: Wireless Control of Fans and Lights:* The first phase of the project concentrates on enabling wireless control of fans and lights in a room. To achieve this, the ESP-8266 microcontroller is utilized to manage relay modules connected to the respective appliances. By integrating the Nodemcu and relay modules, the system allows users to remotely toggle the lights and fans on and off. The Blynk mobile application is employed as an intuitive and user-friendly interface for wireless control.

2) *Phase 2: Fan Speed Control:* Expanding upon the wireless control capabilities established in Phase 1, Phase 2 introduces fan speed control functionality. The LN298N motor driver is employed to enable precise regulation of fan speed and direction. By employing the H-bridge configuration and pulse-width modulation (PWM) techniques, the Arduino Uno, serving as a controller, adjusts the fan speed according to user preferences.

3) *Phase 3: Integrated Circuit Breaker Mechanism:* In Phase 3, the emphasis shifts towards implementing an integrated circuit breaker mechanism to ensure safety in scenarios involving excessive current consumption. The ACS712 current sensor is utilized to measure the currents supplied to individual appliances. This data is then displayed on the mobile application, providing users with real-time feedback. Moreover, a predetermined threshold is established, and if the current surpasses this threshold, the relay modules automatically disconnect power to the specific appliance, mitigating potential hazards.

A. Components Used

1) ESP8266 Microcontroller
2) Motor driver LN298N
3) ACS712
4) DC motor
5) LED bulb
6) Arduino UNO
7) Relay module

IV. DESIGN

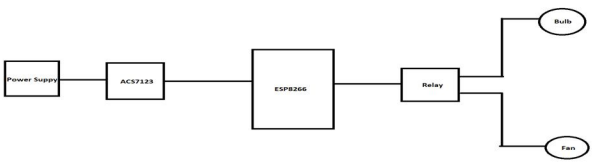


Fig. Block Diagram

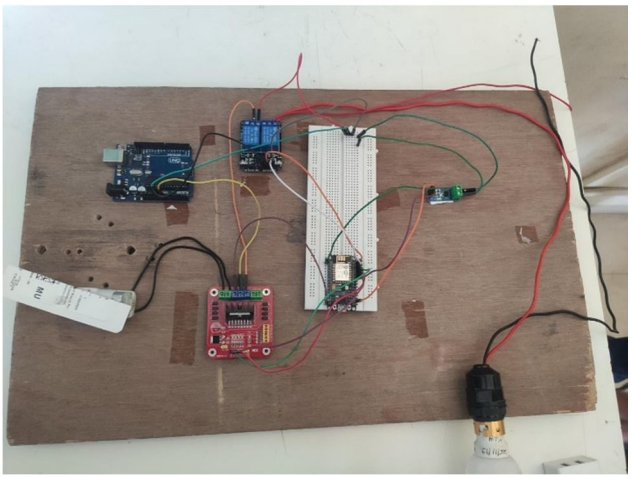


Fig. Hardware Implementation

V. RESULTS

The implemented Simple Home Automation System with the added feature of the circuit breaker was successfully tested and demonstrated. The system provided users with the ability to easily control and connect their devices via a user-friendly app that works over Wi-Fi. Moreover, the circuit breaker feature provided an added level of safety to the system, automatically shutting it off in case of current fluctuations that exceed a pre-determined threshold level. The system remained in a state of shutdown until the current level decreased below the threshold point.

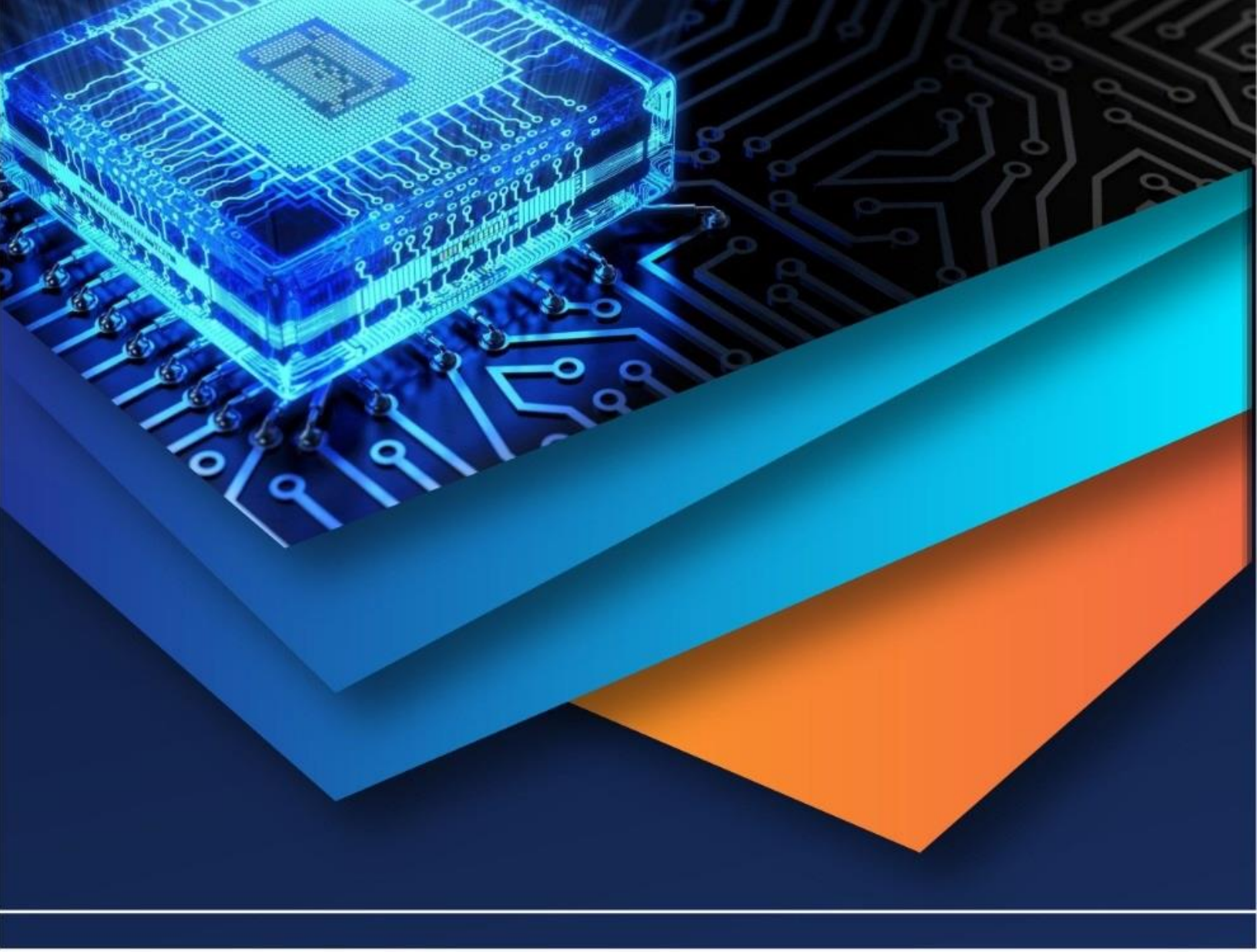
VI. CONCLUSION

In conclusion, System implemented in this project, with the added feature of the circuit breaker, proved to be an effective and reliable system for controlling and connecting devices in a user-friendly manner. The circuit breaker feature provided an additional level of safety and security to the system, ensuring that it would not operate in potentially hazardous conditions. The methodology followed in this project prioritized a user-centric approach to designing and implementing a home automation system that would provide users with a safe, secure, and easy-to-use experience. Overall, the results of this project indicate that the Simple Home Automation System with the added feature of the circuit breaker is a practical and useful solution for controlling and connecting devices in a smart home environment.

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