



## Remote Control Button Presser for Switchboard Panel

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### KEYWORDS

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### ABSTRACT

Remote Control Button Presser is important for improving safety and operational efficiency in electrical switch board panel environments, particularly in high-risk industrial settings. The system is designed to automate the process of pressing electrical panel switch buttons remotely, thereby minimizing direct human exposure to electrical hazards such as arc flash, short circuits, and accidental electric shock. The primary objective of this project is to develop a reliable and precise remote-operated mechanism capable of safely activating panel switches while ensuring the protection of workers and equipment. The system integrates an electromagnetic locking and clamping mechanism to securely attach the device to the panel board. A linear motor actuator is employed to perform the pressing operation, which is controlled via a wireless remote control with a maximum operating range of 20 meters. To enhance operational safety, an automatic protection mechanism is incorporated, where actuator motion is halted once the current threshold preset using a potentiometer is reached. This feature prevents excessive force and potential damage to panel switches. Experimental testing demonstrated that the system successfully transmitted control signals up to 20 meters and consistently activated the linear actuator to press the target switch. The current-limiting safety mechanism effectively stopped actuator motion at the predefined threshold, ensuring safe operation. Overall, the developed system significantly enhances worker safety, reduces operational risks, and improves efficiency in electrical panel switch handling.

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### 1.0 INTRODUCTION

This project focuses on improving the safety and efficiency of operating electrical panel boards by developing a remote-control system that automates the pressing of switch buttons. Manual operations on electrical panel boards often expose workers to significant hazards, such as electrical shocks and other workplace accidents. By addressing these risks, the system aims to provide a safer, more reliable solution for workers while maintaining operational efficiency. The device combines modern technologies, such as remote control and automated mechanisms, to minimise human interaction with hazardous components, making it an innovative approach to addressing workplace safety challenges [1][2]. In many industrial environments, electrical panel boards are central to managing power distribution and other critical operations [3]. However, manual operation of these panels often requires workers to physically interact with potentially dangerous components, increasing the likelihood of accidents [4]. These manual operations expose workers to various risks,

including electrical shocks, burns, and other workplace injuries, especially when dealing with high-voltage or malfunctioning systems. In addition to safety concerns, manual operations can also be time-consuming and inefficient, particularly when switches need to be pressed repeatedly or from difficult angles [5]. To mitigate these risks, the proposed remote-control system automates the pressing of switch buttons, allowing workers to operate electrical panel boards from a safe distance [6], [7]. This innovation significantly reduces the risk of accidents by minimising direct human contact with hazardous electrical components. By integrating modern technologies, such as wireless communication and automated actuators, the system ensures that switches are pressed precisely and reliably without the need for physical presence in the immediate vicinity of the panel [8], [9]. The remote-control system also enhances operational efficiency by streamlining the management of electrical panel boards, reducing the time and effort required for routine tasks. Moreover, the system is equipped with safety mechanisms that prevent accidental damage to electrical components, further enhancing the device's overall safety profile [10], [11]. The inclusion of a current-based safety feature that halts the actuator when current exceeds a preset threshold prevents the linear motor actuator from exerting excessive force on the switches, protecting both the panel and the worker. This combination of automation, remote control, and safety mechanisms represents a significant advancement in how electrical panel boards are operated, offering both immediate safety benefits and long-term improvements in operational effectiveness [12], [13]. Through this approach, the system not only addresses the critical issue of workplace safety but also enhances the overall efficiency and reliability of electrical operations across various industries. In conclusion, this remote-control system provides a highly effective solution to the longstanding challenges associated with manual operations of electrical panel boards [14], [15]. It introduces an innovative approach to reducing workplace hazards, enhancing safety, and improving operational efficiency. The use of automated technologies, combined with advanced safety features, sets a new standard for operating electrical systems safely and efficiently in both industrial and commercial settings.

## 2.0 METHODOLOGY

The proposed system integrates several key components to achieve its objectives. An electromagnetic lock and clamp secure the device to the panel board, ensuring stability during operation. A linear motor actuator is employed to press the switch button, and its motion is controlled using a remote control with a maximum operating range of 20 meters. The system also features an automatic safety mechanism that halts the actuator's linear motion when the current reaches a preset limit set by a potentiometer. This feature prevents damage to the panel board switches and enhances operational safety. The device was tested under various conditions to evaluate its effectiveness in achieving these goals. Figure 2.1 below shows the components inside the block diagram. A block diagram consists of three elements: input, process, and output. The content of the block diagram is derived from the project. Remote control receiver, keypad button, current and potentiometer 10k connected to RP2040 zero as input to control linear motor actuator, electromagnetic lock and LCD I2C as output.

### 2.1 System Design

The remote-control device is designed with key components, including an electromagnetic lock and clamp to secure the device to the panel board, a linear motor actuator to press the switch button, and a remote-control unit capable of operating the actuator over a maximum range of 20 meters. Below is an example of how to frame this project.



Figure 2.1 Frame of the project



Figure 2.2 Frame at the board panel

## 2.2 Safety Mechanism Implementation

The safety mechanism implemented in this project is designed to ensure the secure and precise operation of the remote-control system while protecting the electrical panel switches from potential damage. This mechanism automatically halts the linear motor actuator's movement when the current exceeds a predefined threshold, preventing excessive force that could damage the switch buttons. A potentiometer is used to set this current threshold, allowing for adjustments based on the specific requirements of the panel board or the switch being operated. By calibrating the potentiometer, users can set the maximum allowable current, ensuring the actuator stops immediately if that limit is exceeded. Additionally, the system integrates a current-sensing sensor that continuously monitors the current flowing through the actuator during operation. This sensor works in conjunction with the potentiometer to detect when the current approaches or exceeds the set threshold. Upon detecting such a condition, the system triggers the safety mechanism to immediately stop the actuator's motion. This approach not only enhances the system's safety and reliability but also protects panel switches from damage caused by excessive force, ensuring accurate and efficient operation across various scenarios.

## 2.3 Prototype Development

The prototype development process involved meticulous assembly and calibration to ensure the device's functionality and reliability. The assembly began with integrating the key components, including the electromagnetic lock and clamp, which were securely mounted to the device's frame to ensure stable attachment to the panel board. The linear motor actuator was then installed and aligned with the switch buttons on the panel, ensuring precise actuation. Electrical wiring was carefully configured to connect the remote-control receiver to the actuator and to integrate the current monitoring system, enabling seamless communication and safety mechanisms. The entire system was mounted and encased to provide stability and protect the components during operation. Once the assembly was completed, calibration was performed to optimise the device's performance. The electromagnetic lock was adjusted to ensure a firm grip on the panel board without damaging its surface. The linear motor actuator was calibrated by setting the range of motion and adjusting the force to ensure it could press the switch buttons effectively and without exerting excessive pressure. Fine-tuning and alignment were performed to achieve consistent performance, ensuring the device operated smoothly and reliably across various scenarios. This process was crucial in preparing the prototype for testing and real-world application. Below are the setup hardware and configuration.



## 2.5 Data Analysis

The data collection process showed that when the distance between the project and the remote control was 5 meters, the remote control operated efficiently, transmitting signals without interruption, ensuring smooth communication and consistent functionality throughout use. Figure 2.6 below shows that the distance between the remote control and the projector is 5 meters. While Figures 2.7 and 2.8 show distances of 10 metres and 20 metres. In this project, provide the pressed button based on the current values. Figure 2.9 shows the linear motor actuator pressed push button.



Figure 2.6 Distance remote control in 5 metres



Figure 2.7 Distance remote control in 10 metres



Figure 2.8 Distance is 20 meters



Figure 2.9 Linear motor press push button

## 3.0 RESULTS AND DISCUSSION

The test results demonstrated the system's reliability and effectiveness. The remote control successfully transmitted signals to the receiver within the specified maximum range of 20 meters, enabling smooth activation of the linear motor actuator. The actuator reliably pressed the switch button on the panel board, showcasing its precise operation. The inclusion of the current-based safety mechanism proved critical in protecting the panel switches, as it stopped the actuator when the current exceeded the preset value. This safety feature not only enhanced the system's durability but also ensured accurate and damage-free operation. The findings highlight the practicality and

robustness of the system in mitigating electrical hazards and improving the safety of manual panel board operations. Table 1 below presents the results.

Table 1: Data collection between distance and signal detection

No	Distance At Open Space (M)	Signal Detection
1	2	Reached
2	4	Reached
3	7	Reached
4	11	Reached
5	14	Reached
6	17	Reached
7	20	Reached

The signal detection test was conducted to assess the performance of the remote-control system over varying distances in an open space. The results indicated that signal transmission was reliable up to 20 meters. At each distance increment from 2 to 20 meters, the signal was successfully detected, confirming the effectiveness of the remote-control system in maintaining stable communication within the specified range. Specifically, the signal was detected at distances of 2 meters, 4 meters, 7 meters, 11 meters, 14 meters, 17 meters, and 20 meters, demonstrating the system's robust signal strength and its ability to operate effectively across the entire range without any communication loss. This testing ensures the remote control's reliability even in large, open spaces and ensures consistent operation in practical applications.

#### 4.0 CONCLUSIONS

The developed remote-control device offers a significant advancement in the safe and efficient operation of electrical panel boards. By automating the pressing of switch buttons and incorporating a current-based safety mechanism, the system reduces the risks associated with manual operations and minimises the likelihood of workplace accidents. The successful testing of the device validates its ability to deliver reliable, accurate performance under real-world conditions. This innovation represents a practical, user-friendly solution that can be widely adopted to enhance safety across industries that use electrical panel boards.

#### Author Contribution

Muhd Rostan: Writing and editing. M.Anuar: Investigation, methodology and supervision. Abdul Halim: Conceptualisation, investigation, and visualisation.

#### Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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