

2025年臺灣國際科學展覽會 優勝作品專輯

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TS : System Electrical Safety, Centerlized or Individual , Powered by AI

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Introduction

Electricity has become an essential part of modern life, powering homes, businesses, and industries. However, the misuse of electricity or malfunctioning electrical systems can lead to hazardous situations such as electrical fires, shocks, and significant energy wastage. This project focuses on creating a Comprehensive Electrical Security System to protect users and properties from the risks associated with electricity. The system is designed to prevent electrical malfunctions, ensure safety in various scenarios, and monitor energy consumption effectively. It integrates a variety of sensors and safety mechanisms to detect dangers and take preemptive action

Problem Statement

Electricity can be dangerous if not properly monitored and controlled. Electrical malfunctions can result from overheating, electrical surges, sparks, or human errors, all of which can cause fires, equipment damage, and severe injuries. Conventional safety systems may not always respond in time to prevent these hazards, leading to costly damages and potential loss of life. Therefore, there is a need for a smart, .integrated security system that addresses these issues effectively

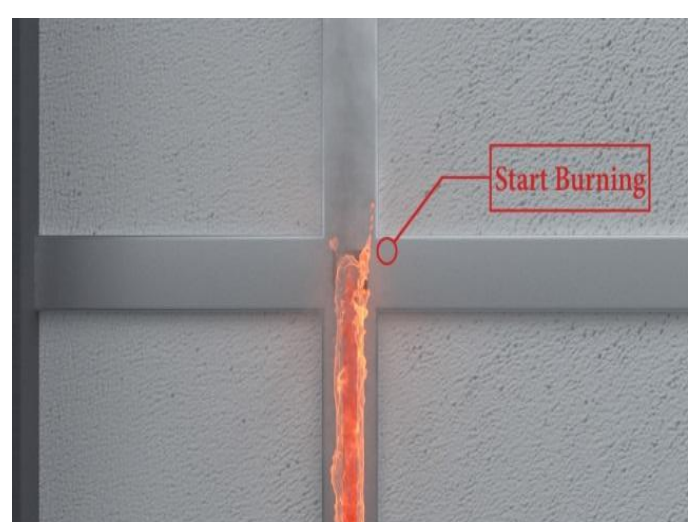
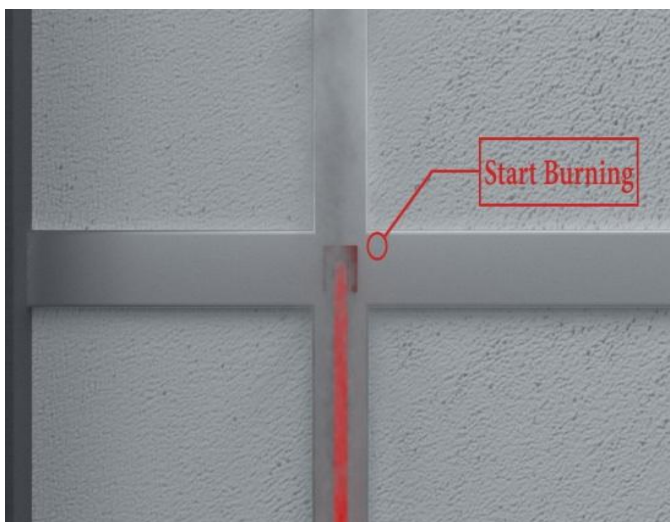
System Overview

The Comprehensive Electrical Security System combines several technologies to monitor electrical circuits and safeguard both property and human life. The system uses various sensors and tactics to detect different electrical problems and responds appropriately in real-time

Key Components of the System

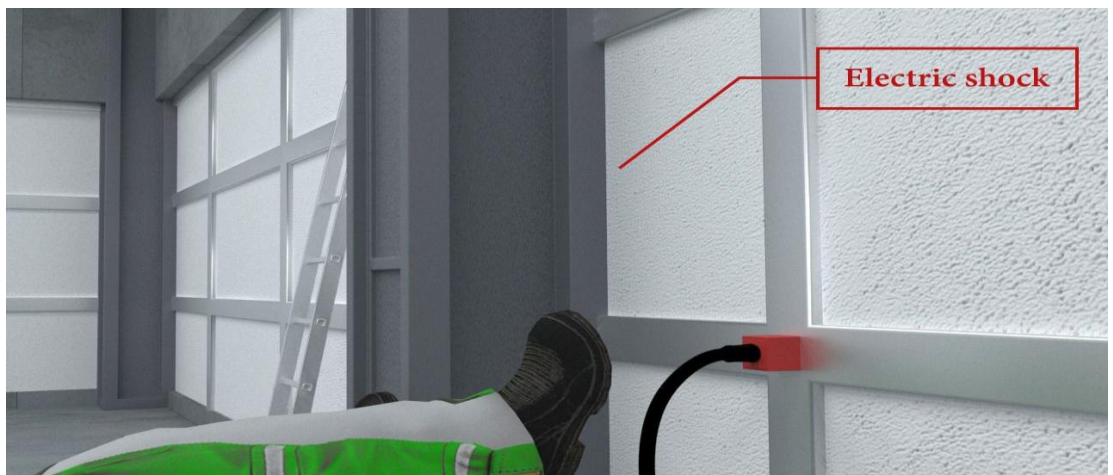
1-Temperature Sensor .

This sensor continuously monitors the temperature around electrical devices or circuits. In the event of excessive heat buildup due to overloading or other factors, the sensor triggers a thermal safety switch, which disconnects the electrical current to prevent overheating, equipment damage, and potential fires



2-Touch Sensor

Designed with human safety in mind, the touch sensor detects when a person touches a plug or electrical outlet. If it senses a potential electric shock hazard, it immediately shuts off the power, protecting the user from electric shock.



3-Spark Sensor .

The spark sensor plays a critical role in detecting electrical sparks, which can occur due to faulty wiring or malfunctioning equipment. When a spark is detected, the system automatically ejects the plug from the socket, stopping any further electrical flow and preventing potential fires or equipment damage



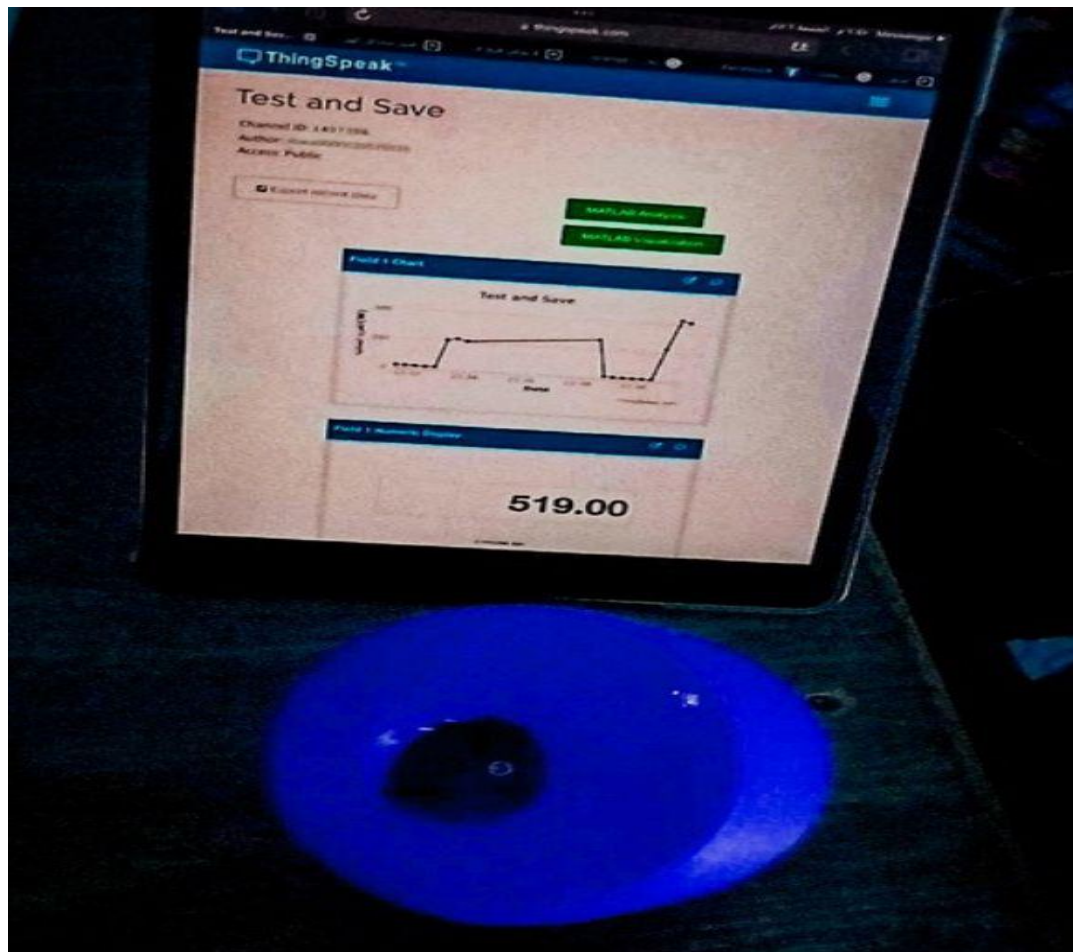
4-Energy Monitoring .

The system is equipped with advanced energy monitoring capabilities, including:

1-Scheduling and Tracking Usage: Users can schedule the operation . of electrical devices and track their usage over time to avoid excessive .consumption

2-Measuring Consumption in kWh and Cost (JOD or USD): It calculates energy consumption in kilowatt-hours (kWh) and provides real-time cost .analysis, helping users to monitor and optimize their energy use

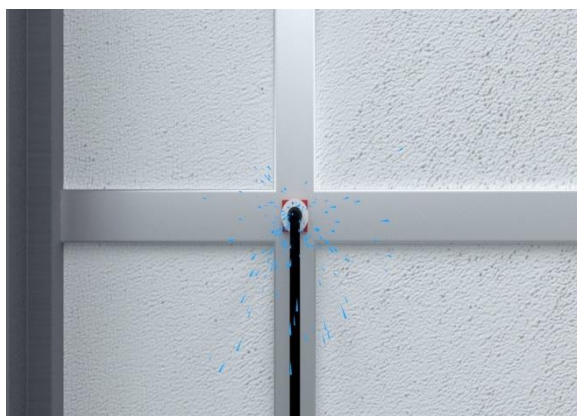
3-Electrical Leak Detection: The system identifies any electrical leaks in the circuit and alerts users to take action before it escalates into a bigger .issue



Project Benefit

1- Water Sensor

Water can be extremely dangerous when it comes into contact with electrical systems. The water sensor is installed to detect any leakage or water presence near electrical outlets. When water is detected, the system instantly shuts off power to the affected area to prevent electrical hazards



2-Five-Second Safety Delay

There will be a chance to check the safety of the plug for five seconds, after which the power is turned on.

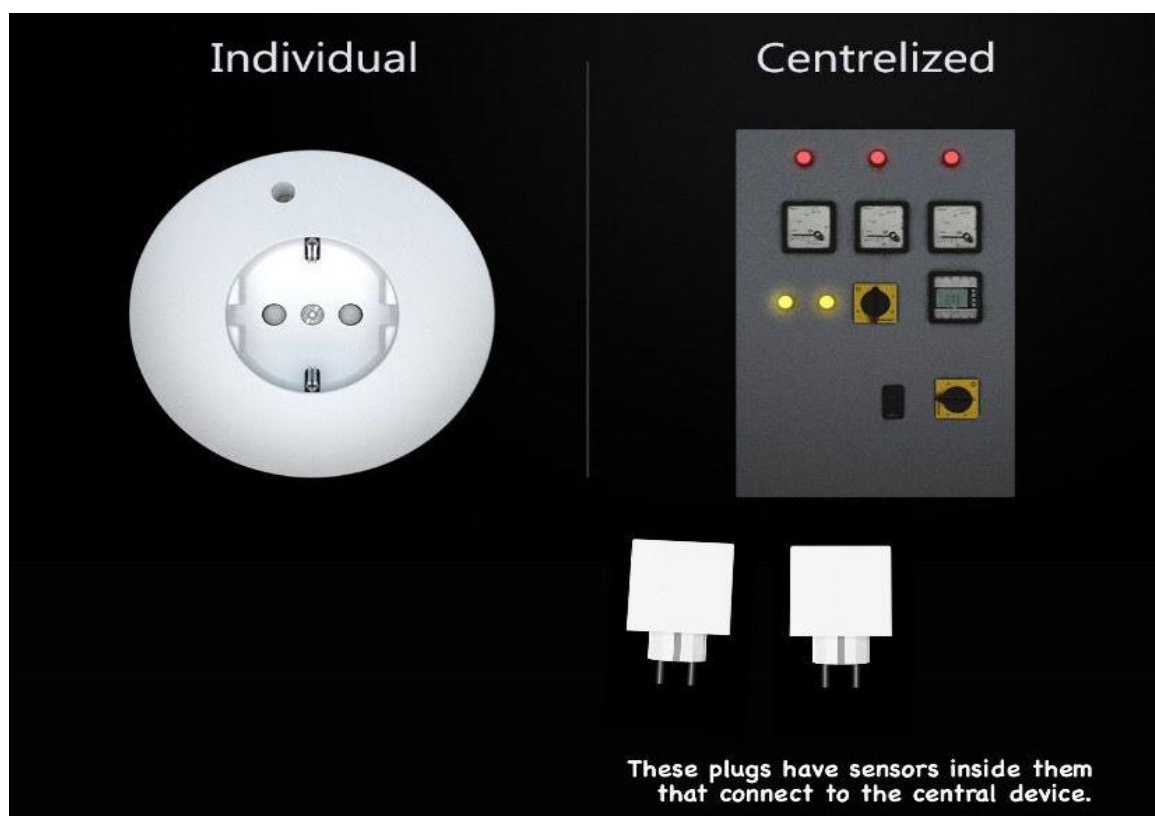
The project proposes two versions of the security system

1-Centralized System

This version is designed for large-scale implementation, such as an entire house or business. It is connected to the main power source and controls the electrical safety of all devices and outlets in the building. The centralized system provides comprehensive monitoring and protection across all circuits, ensuring a high level of safety

2-Individual System

This is a more localized solution, designed for a specific socket or outlet. It is connected directly to the power source of that socket and offers protection only to the connected device or appliance. This variant is ideal for protecting high-risk appliances or locations where full system .integration may not be feasible



New Features and Expansion Ideas

1-AI-Powered System Learning

Integrating artificial intelligence (AI) into the system could enable it - to learn from past incidents and anticipate future problems based on patterns of electrical usage and faults. The AI would be capable of suggesting preventive measures to avoid malfunctions before they occur.

The device alerts to excessive movement around the outlets, giving a warning on the app.

2-Mobile Application Control

Developing a mobile app for remote monitoring and control of the - security system would allow users to receive real-time alerts, check the status of their electrical systems, and even control the power supply .remotely

3-Smart Home Integration

The system could be integrated into existing smart home ecosystems - like **Google Home** or **Amazon Alexa** allowing for voice-activated commands and automated responses to electrical problems, such as .turning off a device if it overheats

4-Solar Power Compatibility

Expanding the system to include compatibility with solar power - setups would help users manage and monitor their energy usage from .both traditional electricity sources and renewable energy

5-Battery Backup

Including a battery backup option could ensure that the security - system remains operational even during power outages, providing .continuous protection for critical appliances and systems

Advantages of the Project

1-Enhanced Safety

The system provides a multi-layered approach to safety by - combining temperature, touch, and spark detection, along with water sensors and delay mechanisms, making it highly effective in preventing .electrical hazards

2-Energy Efficiency

With its energy monitoring features, the system helps users optimize - their electricity consumption, reduce energy waste, and lower their utility bills. The ability to track energy usage in real-time and detect leaks .ensures that electricity is used efficiently

3-Versatility

The system's flexibility, with both centralized and individual - versions, makes it adaptable to different environments, from homes to large businesses. Users can choose the solution that best fits their .needs

4-Cost-Effectiveness

Preventing electrical faults and optimizing energy usage not only - enhances safety but also reduces maintenance costs and energy bills, .making the system a valuable investment

5-Environmental Benefits

By promoting efficient energy use and preventing waste, the system - contributes to reducing the carbon footprint of homes and businesses, .helping to protect the environment

Conclusion

The *Comprehensive Electrical Security System* addresses the urgent need for more effective electrical safety measures. By combining

advanced sensors, energy monitoring, and automated response tactics, it provides a high level of protection against electrical hazards. Whether used in homes or businesses, the system is designed to prevent electrical malfunctions, protect users from harm, and optimize energy consumption. The addition of new technologies like AI integration and mobile app control could further enhance its functionality, making it an essential tool for ensuring electrical safety in the modern world

Future Direction

This project holds immense potential for future growth and expansion. Some potential areas for improvement and exploration include

AI-Powered Predictive Maintenance: Using AI to predict when appliances or systems may fail based on their performance history

Biometric Integration: Implementing biometric sensors for personalized control of electrical systems, ensuring that only authorized users can modify settings or access specific devices

Global Market Expansion: Adapting the system for international markets with different electrical standards and requirements



This report was written by [Namer Mamoun Zyod]

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【評語】 100056

1. The team tackles the daily yet important problem of electricity usage.
2. Please identify the problems to be solved clearly.
3. Please identify the solutions proposed for the problems clearly.
4. Please show the results of experiment clearly.
5. Why it matters to have a 5-second delay for safety.