"LEAKAGE CURRENT DETECTION & ELECTRIC HAZARD PREVENTION SAFETY FOOTWEAR"

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ABSTRACT

Electrical hazards pose serious risks in industrial, commercial, and household environments, often leading to electric shocks, fires, and equipment damage. This project focuses on designing a wearable electrical hazard detection system using a transistor-based circuit instead of complex microcontrollers. The system detects live electrical fields and leakage currents, providing real-time alerts through an led and buzzer. The circuit is lightweight, portable, and energy- efficient, making it suitable for electricians, industrial workers, and general users. Rigorous testing and troubleshooting ensured accuracy, stability, and reliability. This project contributes to enhanced safety measures and can be further improved with wireless alerts, smart integration, and advanced hazard prediction.

Introduction

Electricity is an essential part of modern life, powering industries, households, and agricultural activities. However, electrical hazards pose significant risks to workers, especially in industrial and farming environments, where exposure to live circuits and static discharge can lead to severe injuries or fatalities. Ensuring workplace safety is paramount in preventing electrical accidents.

This project focuses on Wearable Technologies for Electrical Hazard Detection, designed to protect workers and farmers from potential electrical dangers. By integrating advanced detection systems and protective footwear, this innovation aims to provide an efficient, real-time alert system that can minimize the risk of electric shocks and static discharges.

The primary objectives of this project include :-

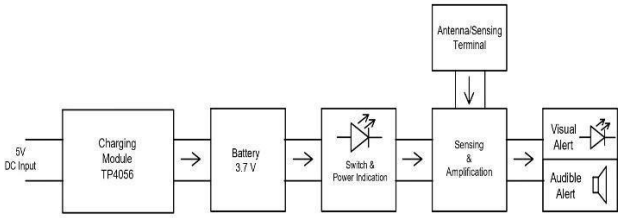
Developing a wearable device capable of detecting electrical hazards in real time.

Ensuring safety for workers and animals by preventing accidental electrical exposure.

By implementing this technology, industries can significantly reduce the risk of electrical accidents, fostering a safer work environment for employees. The integration of smart safety solutions in occupational settings is a crucial step toward modernizing worker protection and reducing workplace hazards.

Proposed Methodology

1. System Design – Designed the circuit using transistors, resistors, an antenna (for detection), and an alert system (LED & buzzer).
2. Component Selection – Chose appropriate electronic components based on sensitivity, power efficiency, and durability.
3. Hardware Development – Assembled the circuit on a breadboard for initial testing and later on a PCB for final implementation.
4. Testing & Calibration – Adjusted resistor values to fine-tune detection sensitivity and optimize power consumption.
5. Troubleshooting & Refinement – Resolved issues like false alarms, weak signal detection, and power drainage.
6. Antenna Integration – An antenna is fixed in the shoe's base to sense leakage current from the ground.
7. Circuit Placement in Shoes – The circuit is fixed inside the shoe, ensuring hands-free operation for the user.
8. Final Implementation – Developed a wearable prototype and validated its performance in real-world environments



Working:

The given circuit diagram represents a touch or proximity sensor alarm circuit that uses a TP4056 charging module, a 3.7V battery, and a transistor-based amplification and switching mechanism to activate a buzzer when a signal is detected.

Power Supply & Battery Charging

A 5V 1A DC power source charges the 3.7V battery using the TP4056 charging module.

The switch allows the battery power to flow to the circuit.

Proximity Sensing Stage

Transistor T1 acts as a sensor, which detects touch or proximity when a human body or conductive object comes close to the antenna/sensing terminal.

This small signal is amplified by T1, turning it on.

Amplification & Switching Stage

When T1 is activated, it triggers T2, which further amplifies the signal.

T2 then turns on T3, which completes the circuit to power the buzzer and LED.

Buzzer & LED Activation

When T3 turns on, current flows through the buzzer and LED, causing an alarm sound and visual indication.

The buzzer continues to sound as long as the sensing input remains active.

Conclusion:

The circuit works as a simple and effective touch/proximity alarm system. It is energy- efficient, rechargeable, and useful for various automation and security applications. successfully detects electrical hazards and provides real-time alerts using a simple transistor-based circuit. Through rigorous testing and troubleshooting, the system has been optimized for accuracy, reliability, and power efficiency. Its compact and wearable design makes it suitable for industrial, household, and outdoor applications. This project contributes to electrical safety by helping prevent accidents, electrocution, and fire hazards. Future enhancements can include wireless alerts and improved sensitivity to expand its effectiveness.

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