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Smart Landmine and Restraining Shoes

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Abstract: ***The smart landmine and restraining shoes project is an innovative solution to reduce the risk of accidental detonation of landmines. The project involves the use of an esp32 module and an RFID tag embedded in a special shoe. When the shoe with the RFID tag is placed on the landmine, it acts as a safety mechanism preventing the mine from being triggered. This technology ensures that the shoes do not trigger the landmines when army personnel steps on them. However, if a terrorist step on the shoe, the RFID tag is detected, causing the landmine to detonate and neutralize the threat.***
Keywords: Smart Landmine, IoT Shoes, Army Project, IoT, ESP32

I. INTRODUCTION

The primary objective of this project is to provide a solution that can help minimize the risks associated with landmines. With the help of RFID technology, the system can distinguish between authorized personnel and unauthorized individuals. The landmine will only be triggered when someone without the RFID-equipped shoes steps on it. The smart landmine and restraining shoe project can be utilized in various settings such as military operations, construction sites, and other areas where the presence of landmines is a concern. It can significantly reduce the risk of accidental explosions and protect human life. Overall, this project demonstrates how innovative solutions can be developed to address complex problems. By utilizing cutting-edge technologies, we can create systems that are not only effective but also safe for the people who use them. The smart landmine and restraining shoes project is a prime example of how technology can be used to save lives, protect us from terrorists and make the world a better place.

II. LITERATURE REVIEW

Reference [1] shows Engineer Bharat J designed an autonomous robot to detect and safely remove landmines. Equipped with sensors, a camera, and a microcontroller, it avoids detonation while removing mines using a specialized arm. Powered by a rechargeable battery, the remote-controlled robot aims to prevent the loss of life caused by landmines.

From the journal [2] we can conclude that this book provides a comprehensive analysis of landmines, covering their history, impact on civilians and the environment, design and technology, mine action efforts, and international legal frameworks. It offers a concise overview of these crucial aspects and their implications in addressing the humanitarian impact of landmines.

Reference [3] shows that the book examines mine action, including mine risk education, survey, and clearance methods, victim assistance programs, and advocacy. It covers landmine types, impact, cultural context, community involvement, and the role of international organizations and governments.

III.BASIC THEORY

A. Major Components

1) *ESP32:* An advanced microcontroller with integrated Wi-Fi and Bluetooth capabilities, used to control and coordinate the functionality of the smart landmine system.
2) *RFID Tags:* Small electronic devices that contain unique identification information. Used in the shoes to provide identification and trigger differentiation when placed on the landmine.
3) *5V Relay Pin:* An electrical switch used to control the activation and deactivation of the landmine circuitry based on the detection of the RFID tag.
4) *LCD 16x2 Display:* A display module that provides visual feedback and information about the system's status and operation.
5) *Lead Acid Battery:* A rechargeable battery that provides power to the landmine system, ensuring its portability and autonomy.
6) *Buzzers:* Audio devices used to generate sound alerts or alarms, providing audible warnings or indications when necessary.
7) *Limit Switch:* A mechanical switch used to detect the presence or absence of the RFID tag on the landmine. It triggers the activation or deactivation of the system accordingly.

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These major components work together to create a smart landmine system that distinguishes between authorized personnel wearing RFID-tagged shoes and potential threats. The ESP32 microcontroller acts as the brain of the system, controlling the relay, displaying information on the LCD display, and activating the buzzers when needed. The lead acid battery provides power for the system's operation, while the limit switch enables the detection of the RFID tag on the landmine, allowing for precise triggering of the detonation mechanism when a threat is detected.

B. Methodology

1) *Landmine Design:* The landmine is equipped with an ESP32 module, which acts as the control unit. It also includes a 5V relay pin for switching the detonation circuitry, an LCD 16x2 display for visual feedback, a lead acid battery for power supply, buzzers for audio alerts, and a limit switch to detect the presence of an RFID tag.
2) *Shoe Design:* The shoes are embedded with an RFID tag that serves as a unique identifier. This tag is programmed to communicate with the landmine's sensor.
3) *Sensor Integration:* The landmine's sensor is designed to detect the RFID tag when a shoe with the tag is placed on it. It is calibrated to differentiate between the weight and pressure patterns of authorized personnel and potential threats.
4) *Activation Control:* When a shoe without an RFID tag is placed on the landmine, the sensor triggers the 5V relay pin, activating the detonation circuitry and rendering the landmine operational. However, when a shoe with the RFID tag (worn by authorized personnel) is placed on the landmine, the sensor recognizes the tag and prevents the activation of the detonation mechanism.
5) *User Safety and Protection:* The system's primary objective is to protect army personnel. By allowing only shoes with the RFID tag to avoid triggering the landmine, accidental detonations are prevented. In the event of a potential threat, such as a terrorist, stepping on the landmine without the RFID-tagged shoe, the sensor detects the absence of the tag and triggers the detonation, neutralizing the threat.

C. PCB Layout of Landmines

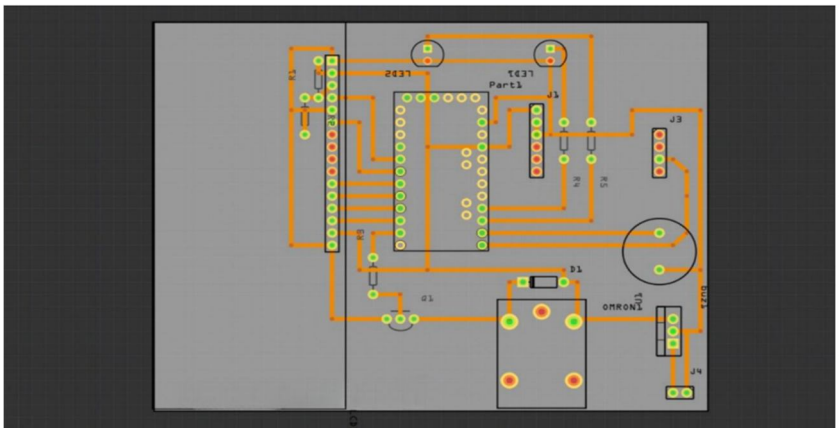


Fig. 1 PCB design in landmines

D. Prototype of Smart Landmines

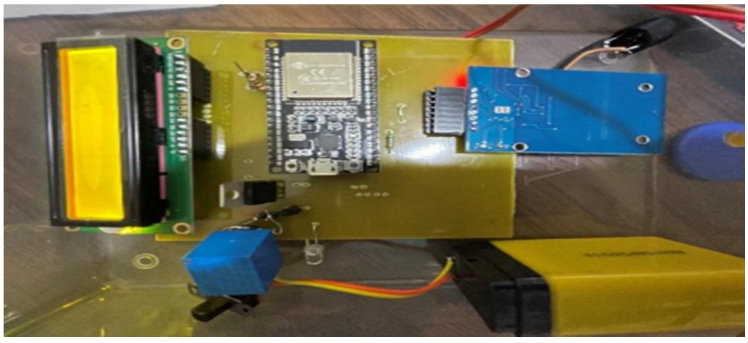


Fig. 2 Prototype design of smart landmines

IV. CONCLUSIONS

In conclusion, the smart landmines and restraining shoe project successfully address the safety concerns faced by the military. By utilizing an ESP32 module in the landmine and an RFID tag in the shoe, the system ensures that the landmine remains inactive when soldiers wearing the proper shoes step on it, preventing any accidental detonations.

However, the system is designed to detect shoes without the RFID tag, triggering the landmine when a potential threat, such as a terrorist, steps on it. This innovative approach enhances the security of the military forces by effectively differentiating between authorized personnel and potential adversaries.

This project offers a significant advancement in landmine safety technology, reducing the risk of unintended harm to friendly forces while maintaining the ability to neutralize threats. It exemplifies the successful integration of sensor technology and RFID tagging for enhanced military protection and underscores the importance of innovation in safeguarding our armed forces.

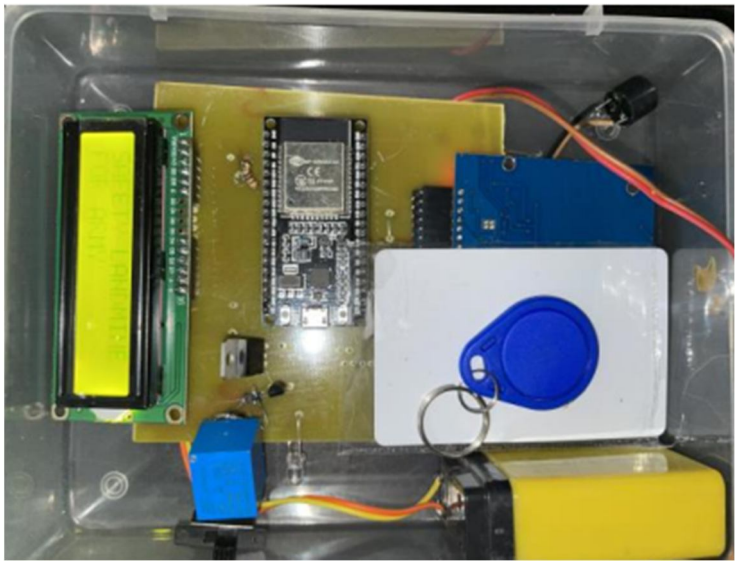


Fig. 3 Glimpses of smart landmines and RFID tags

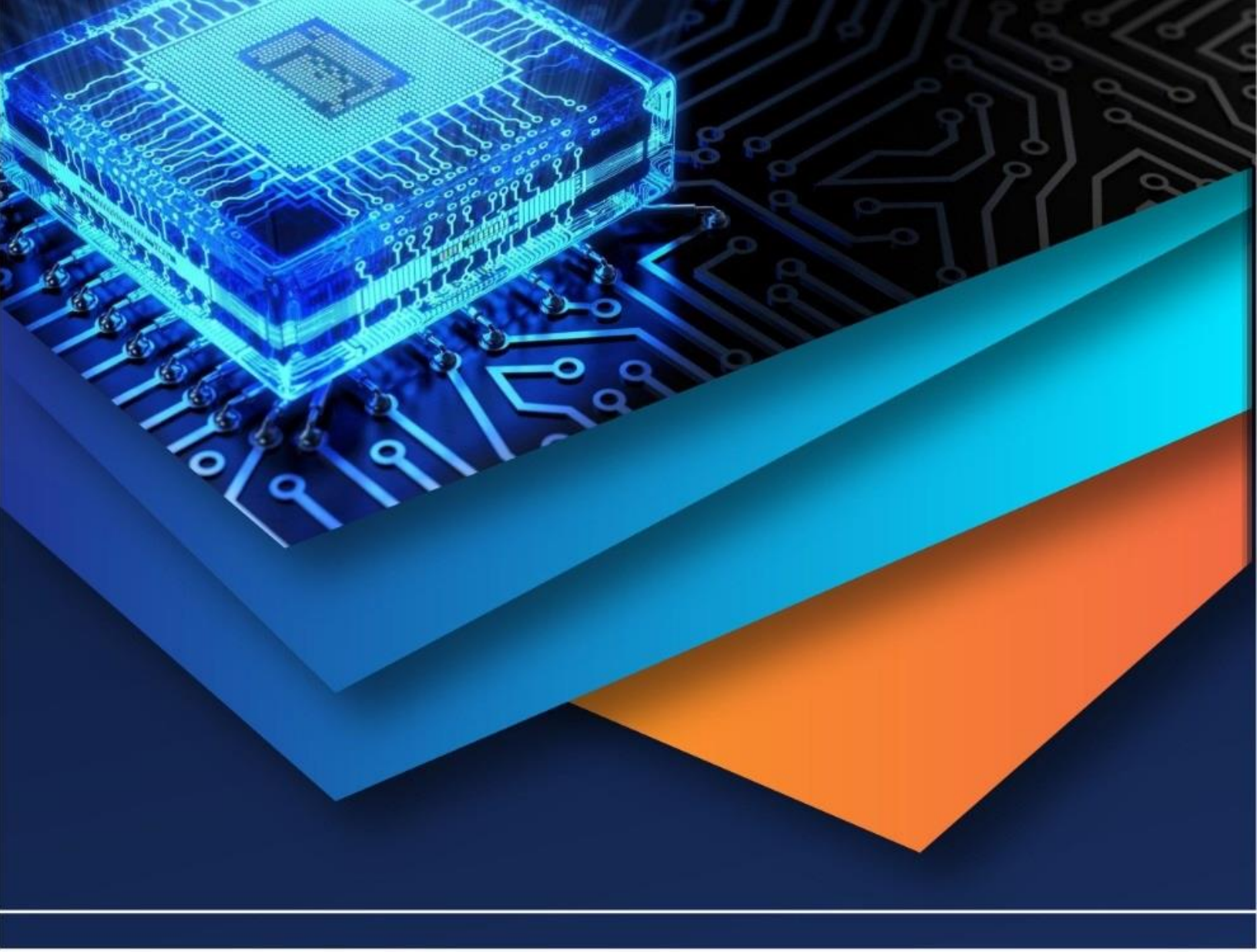
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