https://doi.org/10.48047/AFJBS.6.Si4.2024.5948-5954

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

SMART LANDMINE "FUTURE OF BATTLEFEILD"

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Volume 6, Issue Si4, Aug 2024

Received: 15 June 2024

Accepted: 25 July 2024

Published: 15 Aug 2024

doi: 10.48047/AFJBS.6.Si4.2024.5948-5954

ABSTRACT

The smart landmine project yodescribed demonstrates an innovative approach to enhancing safety for military personnel and improving defense capabilities against potential threats. By integrating RFID technology into specialized shoes worn by authorized personnel, the system effectively mitigates the risk of accidental detonations while maintaining readiness against unauthorized access. The use of RFID modules and tags allows for precise identification and authentication of personnel, ensuring that only authorized individuals can safely traverse areas potentially containing landmines. This proactive safety measure not only protects soldiers but also minimizes the risk of collateral damage and unintended consequences associated with traditional landmine deployment. Furthermore, the system's ability to detect unauthorized access and trigger the landmine in response to hostile incursions enhances perimeter security and serves as a deterrent against enemy infiltration. By leveraging advanced technology in this manner, military forces can maintain a strategic advantage while prioritizing the safety and well-being of their personnel. Overall, the smart landmine project represents a forward-thinking solution that addresses critical safety concerns in military operations, underscoring the importance of innovation in safeguarding personnel and defending against evolving threats

Keywords- Detection; Neutralizing; RFID technology; military operations; Landmine

I. INTRODUCTION

The term "Smart Landmine" or "Friend and Foe Mine" indeed refers to a category of next-generation landmine designs currently under development by various military forces globally. These advanced landmines are equipped with sophisticated technologies that allow them to differentiate between friendly forces (authorized personnel) and potential threats (hostile actors or unauthorized intruders). The integration of sensors, communication systems, and identification/authentication mechanisms enables these smart landmines to distinguish between friend and foe, reducing the risk of accidental detonations while enhancing operational denial, and force protection while adhering to principles of humanitarian law and minimizing civilian casualties.

effectiveness. By leveraging such technology, military forces aim to improve situational awareness, minimize the likelihood of friendly fire incidents, and enhance overall safety for personnel operating in conflict zones or hostile environments. The development of smart landmines represents a significant advancement in military engineering, as it not only addresses longstanding concerns related to the indiscriminate nature of traditional landmines but also reflects a commitment to adopting more precise and selective methods of target engagement. These innovative systems are poised to play a crucial role in future conflict scenarios, offering enhanced capabilities for perimeter defense, area

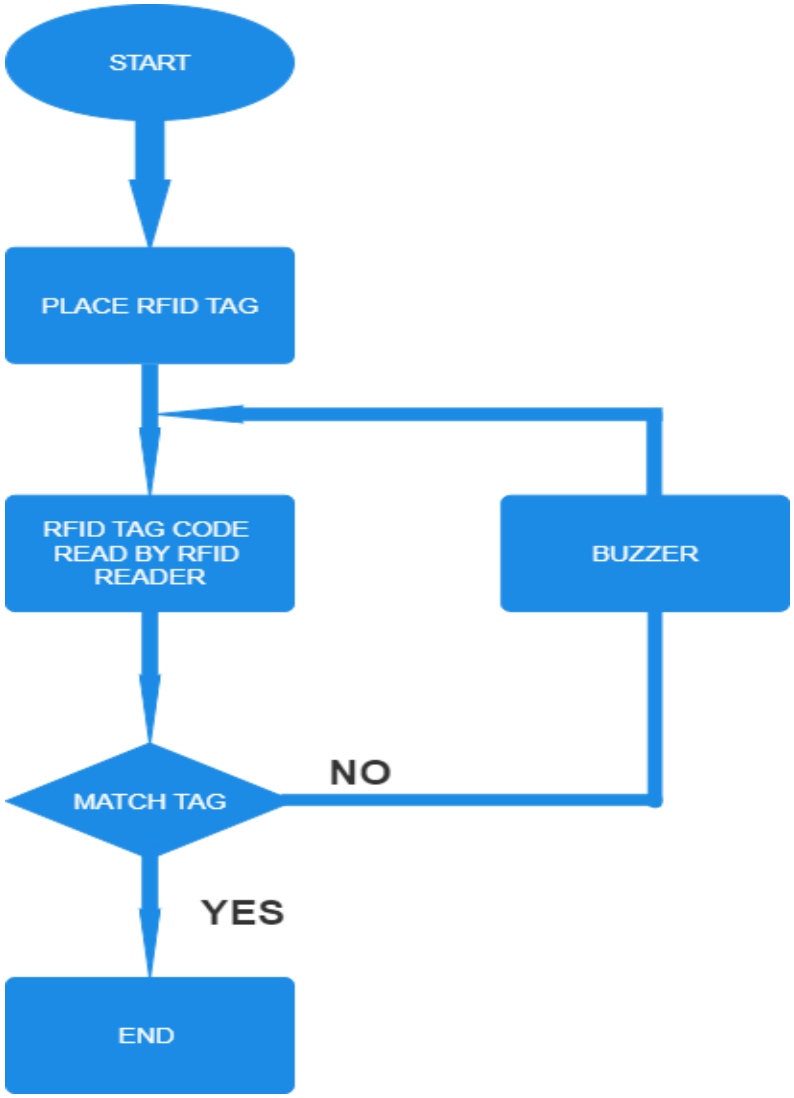

FIG 1: -FLOW OF SMART LANDMINE WORKING PRINCIPLE

2. Methodology

RFID (Radio-Frequency Identification**)** is a technology that uses electromagnetic fields to automatically identify and track tags attached to objects. These tags contain electronically stored information. The RFID system consists of three main components: the RFID tag, the RFID reader, and the backend database system.

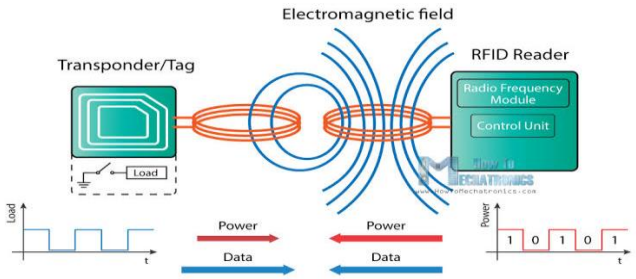

FIG 1: XXXXXX

RFID Reader: The reader, also known as an interrogator, sends and receives radio waves to communicate with RFID tags. It emits radio waves via its antenna, which power the RFID tags within its range. When an RFID tag receives these **radio waves, it responds by transmitting its data back to the reader.**

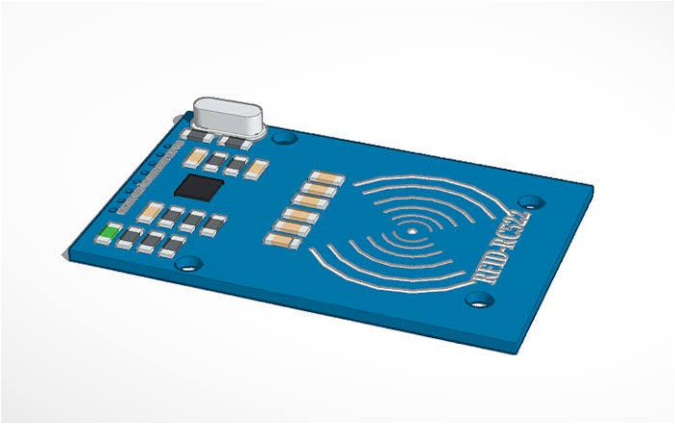

FIG 3: -RFID READER

RFID Tag: This is a small electronic device that consists of a microchip and an antenna. The microchip stores the item's unique identifier and other relevant data, while the antenna enables the tag to transmit this information to an RFID reader.

RFID (Radio-Frequency Identification) is a technology that uses electromagnetic fields to automatically identify and track tags attached to objects. These tags contain electronically stored information. The RFID system consists of three main components: the RFID tag, the RFID reader, and the backend database system.

RFID (Radio-Frequency Identification) readers emit radio waves to communicate with RFID tags wirelessly. When an RFID reader sends out radio waves, any nearby RFID tags within range will be powered by the energy from these waves and respond by transmitting their stored data back to the reader. The reader then captures this data and processes it, enabling the identification and tracking of objects, assets, or individuals tagged with RFID technology.

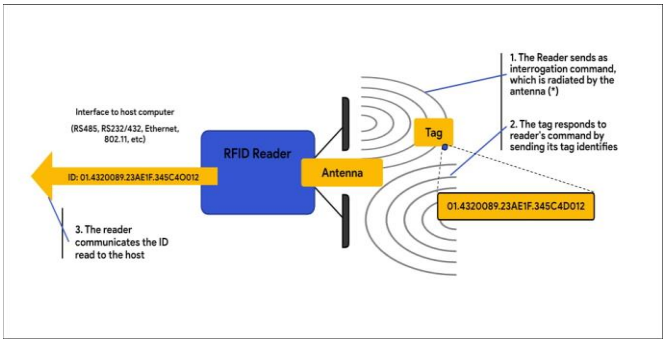

FIG 4: - HOW RFID TECHNOLOGY WORKS

RFID systems consist of three main components:

- RFID Tags
- RFID reader
- Middle and Backend data systems

RFID Tags: These are small electronic devices that contain an integrated circuit (chip) and an antenna. The chip stores data, such as a unique identifier or other information about the tagged item. The antenna allows the tag to receive and transmit data using radio waves.

RFID Readers: These are devices that emit radio waves and are equipped with antennas to communicate with RFID tags. The reader sends out signals to power nearby RFID tags and receives the data transmitted by the tags.

Middleware and Backend Systems: These are software applications and databases that manage the data collected by RFID readers. They interpret the information received from the readers, process it, and make it available for various applications, such as inventory management, asset tracking, access control, and security.

Overall, RFID technology offers a convenient and efficient way to identify, track, and manage assets or objects in a wide range of applications, including supply chain management, retail, logistics, healthcare, and security. Its wireless and contactless nature makes it suitable for automating processes and improving efficiency in various industries.

2.1 CIRCUIT DIAGRAM OF SMART LANDMINE: -

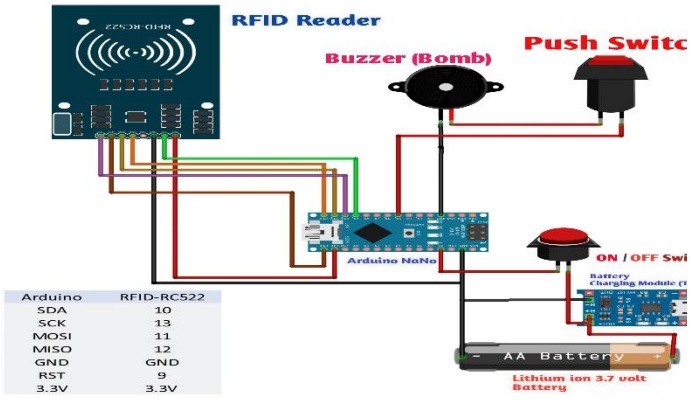

FIG 5:- CIRCUIT DIAGRAM OF SMART LANDMINE

Components used in Smart Landmine: -

- RFID READER
- RFID TAG
- ARDUINO NANO
- CHARGING MODULE
- BUZZER
- PUSH SWTICH
- TWO PIN SWITCH (ON/OFF)
- LITHIUM ION BATTERY

Arduino Nano: -

- It is a compact and versatile microcontroller board that is part of the Arduino family.
- It is very small in size and used mostly used where the space is limited.
- It is having USB connectivity which is able to connect with our computer or laptop.
- The nano can also be powered with the USB connection or rom some external source.
- The code needs to be upload into the Arduino using the USB cable and C, C++ languages are used for the programming.
- It is widely used in the small electronic devices and educational application

RFID Reader: -

- RFID- Radio Frequency Identification.
- In this project we use RFID Reader RC522 it is a popular RFID model it uses MFRC522 for the communication.
- The MFRC522 is the highly integrated reader integrated circuit for contactless communication at 13MhHz.
- This RC522 operated at the high frequency range of 13.56MHz.
- RC522 is only able to read only few centimeters from the RFID reader and it depends on the size of the antenna and the tag used.
- This RFID readers are widely used.
- The RFID Reader having one or more number of antennas it emits the radio waves and receives the signal back from the RFID tag.

RFID Tag: -

- RFID tags are a kind of tracking technology that identifies objects using intelligent barcodes.

- Since "radio frequency identification" is what RFID stands for, radio frequency technology is used by RFID tags.
- Data from the tag is transmitted by these radio waves to a reader, which subsequently forwards the data to an RFID computer software.
- RFID tags are widely used for tracking goods, but they may also be used to track cars, animals, and even Alzheimer's sufferers.
- An antenna and a microchip, commonly known as an integrated circuit or IC, are used by an RFID tag to broadcast and receive data.
- Any information that the user desires may be written onto the microchip of an RFID reader.

- **Battery Charging Module: -**

- This battery charging module is a device designed to safely charge the rechargeable batteries.
- We are using the lithium-ion battery and this rechargeable battery is need to be charged.
- The module having small LEDs to indicate the charging status whether the battery is charging or fully charged.
- Most of the charging modules having the protection features such as overcharging protection, over discharging protection, short circuit protection.
- In some modules we are able to adjust the charging current and voltage.
- Some of the modules are having the USB ports to making them convenient for charging.
- The battery charging modules having the heat sink to dissipate the heat generated during the process.

- **Lithium Ion Battery: -**

- A battery is a electromechanical device which charged with the electric current and discharged whenever required.
- The lithium-ion battery is a rechargeable battery which can be recharged and reused.
- The first lithium-ion battery was invented by the British scientist Dr. Stanely Whittingham in the year 1970.
- These batteries are great at holding their charge and having some basic components like Anode, Cathode, Electrolyte and A Separator.
- Lithium-ion batteries are widely used in the electronic devices due to its high energy density.
- The Lithium-ion batteries having more life span then the other types of rechargeable batteries.

Push Switch: -

- A push switch, often known as a button, is a momentary or non-latching switch that only modifies the state of an electrical circuit momentarily when it is physically activated.

Buzzer: -

- An audio signaling device, often known as a buzzer or beeper, can be mechanical, electromechanical. Buzzers and beepers are commonly used in alarm systems, timers, training systems, and as a means of verifying user input, such as mouse clicks and keystrokes.

2.2 PROTOTYPE MODEL AND INTERNAL CONNECTION*:* -

FIG 6:- PROTOTYPE OF SMART LANDMINE

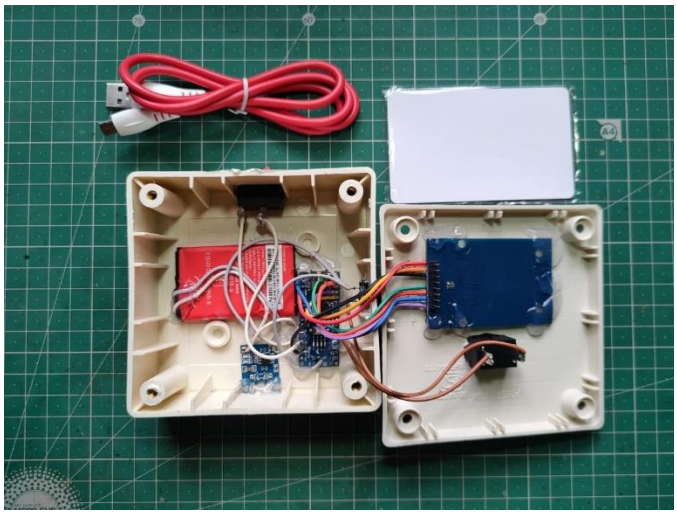

FIG 7: - INTERNAL CONNECTION OF SMART LANDMINE

HOW THE SMART LANDMINE WORKS: -

- The supply of the landmine is switch "ON" then the total circuit will start working and it is indicated with the help of a LED light on the Arduino nano.
- The Arduino nano has been already coded before to run the circuit.
- Place the RFID tag on the RFID reader by pressing the push switch on the landmine to read the code of the tag.
- Wait for 10 seconds and place the RFID tag on the landmine by pressing the push switch, then the buzzer will not make any sound. It indicates the landmine will not explode by stepping on it with RFID tag.
- After that without RFID tag press the push switch then the buzzer starts making sound. It indicates the landmine will explode in the absence of the RFID tag.

A. **DIFFERENT CHALLENGES AND ISSUES FACED: -**

4. Challenges faced in smart landmine technology

- Technological Limitations
- Terrain and Environmental Conditions
- Cost and Accessibility
- Data Management and Analysis
- Legacy Minefields
- RFID card range is less

APPLICATIONS OF SMART LANDMINE: -

- 1)Used in Armedforces
- 2)Used In battlefield
- 3)At military bases for security purposes
- 4)Used in Borders

RESULTS AND DISCUSSIONS: -

- Advanced technology
- Improved signature
- It is more efficient than normal landmine
- Accuracy is more
- Enhanced safety
- Cost savings
- Neutralizing is easy

3. CONCLUSION:

In conclusion, the integration of RFID (Radio-Frequency Identification) technology into smart mine solutions represents a significant advancement in enhancing the effectiveness and efficiency of landmine detection, monitoring, and neutralization efforts. By incorporating RFID tags into various components of the smart mine ecosystem, including landmine detection equipment, demining tools, and clearance equipment. Smart landmines are to enhance safety for military personnel by minimizing the likelihood of accidental detonations while maintaining effectiveness against enemy forces. smart landmines are to enhance safety for military personnel by minimizing the likelihood of accidental detonations while maintaining effectiveness against enemy forces.

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