VIT-AP UNIVERSITY

Engineering Clinics

Emergency Alert System and Security Device Activation

EC Id: 230823

PROJECT REPORT

Project Guide

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Problem statement

In universities, there is a need for an efficient emergency alert system that can quickly notify security personnel in the event of an emergency. The existing methods of communication and alerting may have limitations in terms of speed and accuracy. In order to enhance the emergency response capabilities, there is a requirement to develop an RFID-based system that can leverage the ID cards used by students and staff.

The system should allow for the installation of RFID scanners near classrooms in each block of the university. These scanners will read the RFID tags on the ID cards to verify user identity. Upon successful ID card verification, an automated security device activation box should open, providing access to buttons with different security alert functionalities.

The security alert buttons should be labeled accordingly, indicating the specific type of alert to be triggered, such as block-level, main office, or university-wide alerts. When a button is pressed, the system should send the appropriate alert notifications to the relevant security personnel based on the emergency situation.

Additionally, the system should incorporate a monitored display in the main office or security control room. This display should provide real-time information about the activated security alert button, indicating the classroom location from where the alert was triggered. This information will enable security personnel to respond promptly and efficiently to the emergency situation.

The key challenges to address in this project include developing a reliable and accurate RFID card verification system, designing an automated security device activation box, implementing the alert notification mechanism, integrating the monitored display, and ensuring seamless communication between the RFID readers, centralized system, and security personnel.

The goal of this project is to create a robust RFID-based emergency alert system that can enhance the safety and security of universities by providing quick and effective communication between individuals in distress and the security personnel responsible for emergency response.

Abstract

The RFID-based emergency alert system proposed in this project aims to enhance the safety and security measures in universities by leveraging RFID technology. The system involves the installation of RFID scanners near classrooms in each block of the university. These scanners are used to verify the identity of students and staff by reading RFID tags embedded in their ID cards.

Upon successful verification, an automated security device activation box is triggered, providing access to buttons with different security alert functionalities. These buttons are labeled to indicate block-level, main office, or university-wide alerts. When a button is pressed, the system sends immediate alert notifications to the appropriate security personnel based on the nature and severity of the emergency.

To enable effective monitoring and response, a centralized system is implemented, which communicates with the RFID readers, manages the database of ID card information, and coordinates the security alert notifications. Additionally, a monitored display is set up in the main office or security control room, providing real-time information about the activated security alerts and the corresponding classroom location.

By implementing this RFID-based emergency alert system, universities can significantly improve their emergency response capabilities. The system enables swift communication, accurate identification of emergency locations, and immediate notification to security personnel, facilitating a prompt and efficient response to critical situations. Ultimately, the system aims to enhance the safety and security of university campuses, ensuring the well-being of students, staff, and faculty members.

Goals

- Enhance Emergency Response Capabilities.
- Improve Campus Safety and Security.
- Establish Efficient Communication Channels.
- Integrate with Existing Infrastructure.
- Ensure Scalability and Adaptability.
- Foster a Culture of Safety.

Objectives

- Implementing a Reliable RFID Card Verification System.
- Designing an Automated Security Device Activation Box.
- Developing a Centralized System for Communication and Coordination.
- Enabling Different Security Alert Functionalities.
- Creating a Monitored Display for Real-Time Information.
- Ensuring Integration and Compatibility.
- Testing and Validation.
- Enhancing Emergency Response Capabilities.

Project Description

Our project is focused on developing an RFID-based emergency alert system for universities. The system aims to enhance the safety and security measures on university campuses by utilizing RFID technology. We plan to install RFID scanners near classrooms in each block of the university. These scanners will read the RFID tags embedded in the ID cards of students and staff.

Once a card is successfully verified, an automated security device activation box will open, providing access to buttons with different security alert functionalities. These buttons will be labeled to indicate block-level, main office, or university-wide alerts. When a button is pressed, the system will immediately notify the relevant security personnel based on the nature and severity of the emergency.

To facilitate effective monitoring and response, we will implement a centralized system that communicates with the RFID readers, manages the database of ID card information, and coordinates the security alert notifications. Additionally, a monitored display will be set up in the main office or security control room to provide real-time information about the activated security alerts and the corresponding classroom locations.

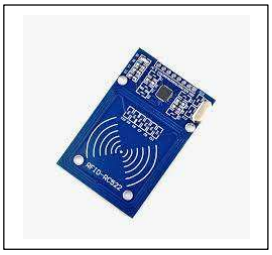
By implementing this RFID-based emergency alert system, we aim to significantly improve the emergency response capabilities of universities. The system will enable swift communication, accurate identification of emergency locations, and immediate notification to security personnel, facilitating a prompt and efficient response to critical situations. Overall, our project focuses on enhancing the safety and security of university campuses by leveraging RFID technology and efficient alert systems.

Components

Node MCU

Presentations are communication tools that can be used as demonstrations, lectures, speeches, reports, and more.NodeMCU is an open-source, Wi-Fi enabled development board based on the ESP8266 microcontroller. It combines a robust Wi-Fi module with GPIO pins, making it easy to connect and control various sensors and actuators. NodeMCU is programmable with the Arduino IDE or through Lua scripting. It is widely used for IoT projects, home automation, and prototyping due to its compact size, affordability, and built-in Wi-Fi capabilities, enabling seamless connectivity to the internet and cloud services.

RFID/NFC TAG

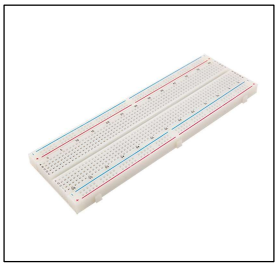


RFID/NFC tags are small electronic devices that store and transmit data wirelessly using radio frequency technology. RFID tags operate at various frequencies, such as 125 kHz or 13.56 MHz, while NFC tags operate at 13.56 MHz. They are used for identification, tracking, and contactless data exchange. When brought into proximity with a compatible reader or smartphone, the tags transmit information without requiring a power source of their own. Applications include access control, asset tracking, contactless payments, and interactive marketing.

BUZZER

A buzzer is an electronic audio signaling device that produces sound when an electrical signal is applied. It typically consists of a piezoelectric element that vibrates and generates sound waves when voltage is applied to it. Buzzer modules are widely used in electronic projects and alarm systems due to their simplicity, low cost, and ease of use. They come in different sizes and types, including passive and active buzzers. Passive buzzers require an external oscillating signal to produce sound, while active buzzers have an internal oscillator and only need a DC voltage to operate.

Bread Board



A breadboard, also known as a prototyping board or solderless breadboard, is a device used in electronics for quickly assembling and testing circuits without the need for soldering. It consists of a flat surface with a grid of interconnected holes or sockets that allow electronic components like resistors, capacitors, and wires to be inserted and connected easily. The holes are connected in rows and columns, providing a convenient platform to arrange and experiment with components, enabling rapid circuit design and testing. Breadboards are widely used by hobbyists, students, and professionals to prototype and iterate on circuit designs before creating permanent versions on PCBs (Printed Circuit Boards).

Jumper Wires

Jumper wires are flexible and insulated wires with male connectors on both ends, used to create temporary connections between electronic components on a breadboard or a prototyping board. They facilitate quick and easy circuit building without the need for soldering. Jumper wires come in various lengths, colors, and types (e.g., male-to-male, male-to-female, female-to-female) to accommodate different project requirements. They are essential tools for prototyping, experimenting, and testing electronic circuits, allowing easy reconfiguration and modification during the development process.

LED

On passing a current through the diode, minority, and majority charge carriers recombine at the junction. On recombination, energy is released in the form of photons. Generally, leds work on the principle of Electroluminescence.

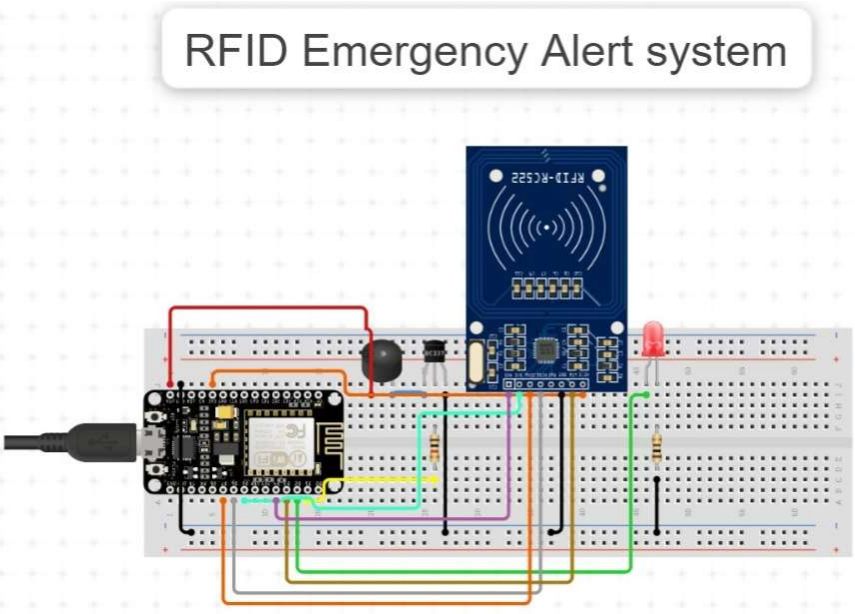
Working of Project

When a RFID tag is scanned, a buzzer will sound two quick beeps with a 200ms pause, and an LED will light up. This indicates an emergency, signaling security personnel to go to the area where the RFID tag was scanned. The security guard must then scan their authorized RFID tag again to turn off the LED. After this, appropriate actions will be taken to address the emergency situation. The information from the scanned RFID tag will be securely logged in Google Sheets. This ensures that the system cannot be misused for inappropriate purposes, as all activities are documented and traceable.

Project Setup

- Connect the MFRC522 RFID module, the emergency push button(s), and the display module (if using) to the Arduino using jumper wires according to the pinout specifications.
- Connect a buzzer or siren to the Arduino to serve as the alarm.
- Set up the RFID tag database in the Arduino memory, mapping authorized RFID tag IDs for college staff or emergency responders.
- Implement the Google Sheets API for data storage. To do this:

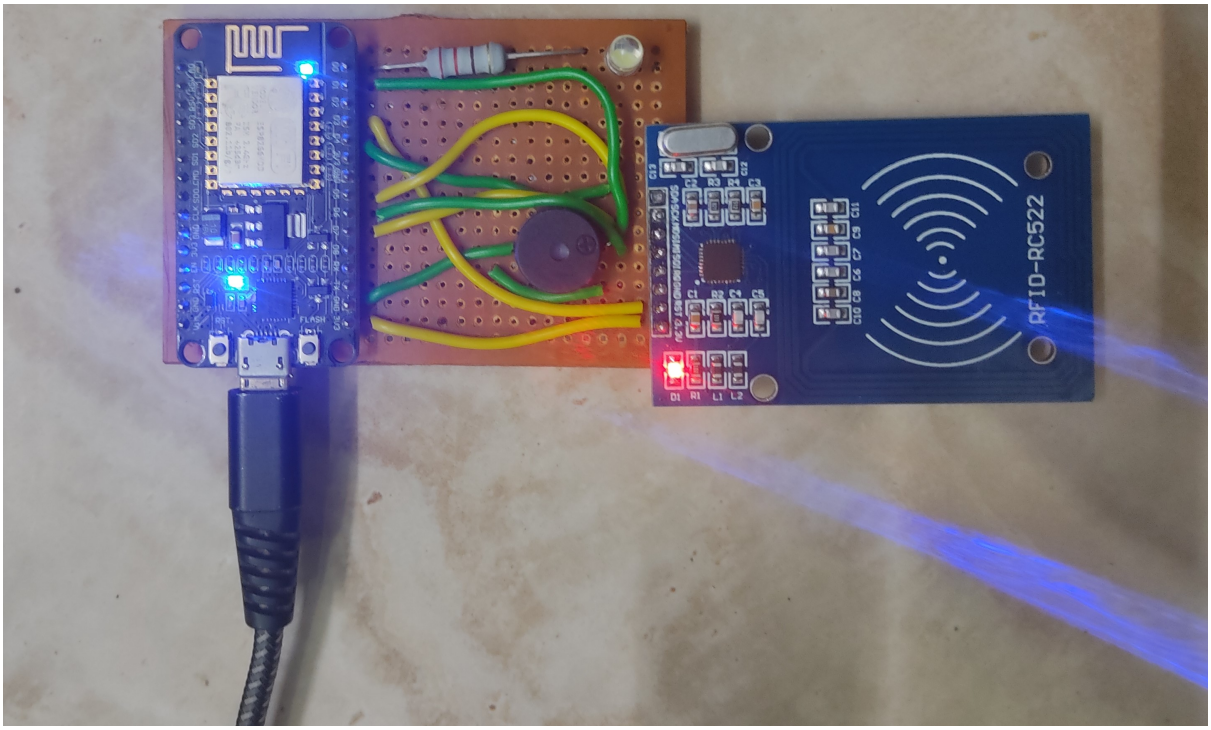
  - a. Go to the Google Developers Console ((The RFID-Based Emergency Alarm System with Google Sheets Integration is a versatile and effective project designed to enhance security and emergency response capabilities in college or similar environments. The system combines Radio Frequency Identification (RFID) technology with an Arduino microcontroller to allow authorized personnel to trigger emergency alarms and store user information in a Google Sheets spreadsheet. This integration ensures quick access to critical data for efficient emergency response and management.).).
  - b. Create a new project.
  - c. Enable the Google Sheets API for your project.
  - d. Create credentials (OAuth 2.0 Client ID) for your project to obtain the necessary authentication tokens.
  - e. Obtain the Google Sheets API library for Arduino (e.g., "Google Sheets Arduino Library").



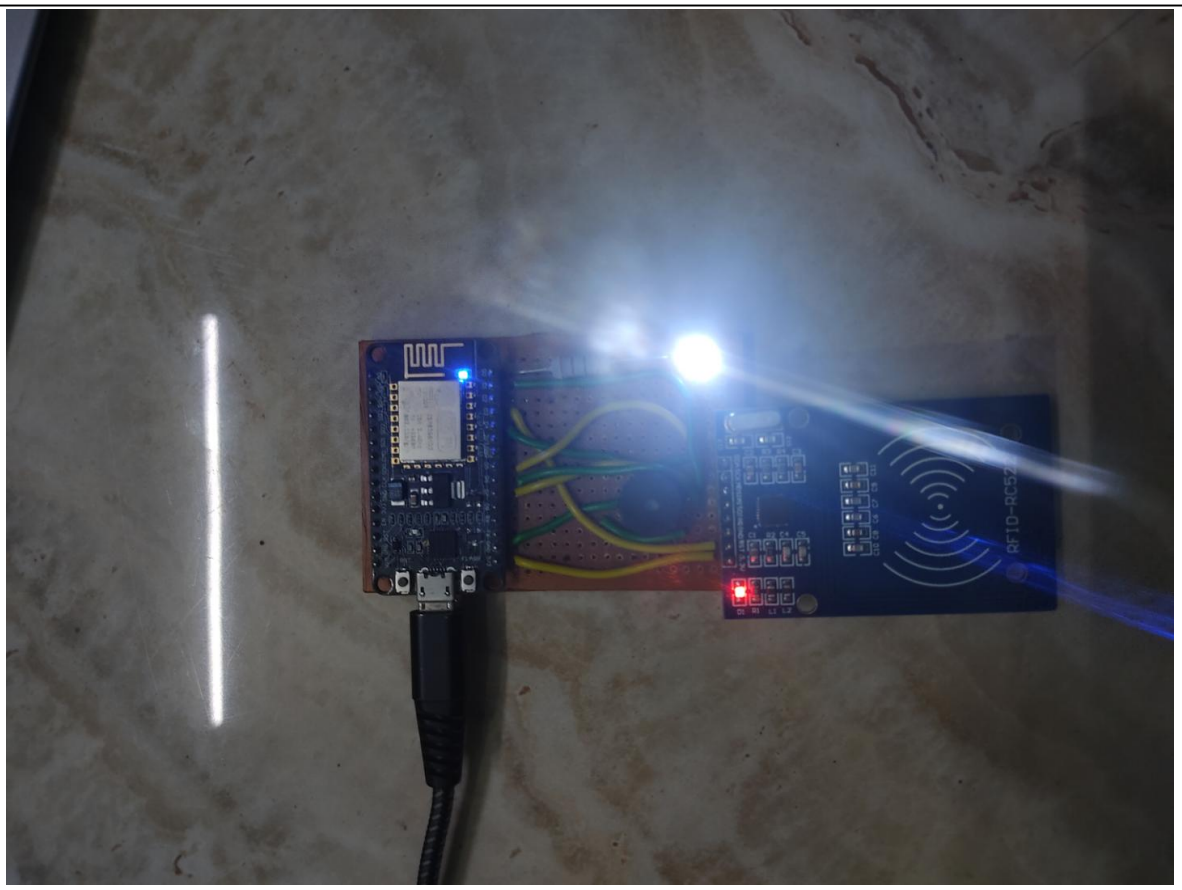
-- Modelling of Prototype

Project Functionality

- Initialization: Pre-program the Arduino with the authorized RFID tag IDs and upload the code to the board.
- Scanning RFID Tag: At the beginning, the Arduino waits for an authorized RFID tag to be presented to the RFID sensor.
- RFID Tag Detection: When an authorized RFID tag is presented to the RFID sensor, the Arduino confirms the ID and proceeds to show the emergency options and user information.
- User Information: Retrieve information about the person associated with the scanned RFID tag from the external data storage (Google Sheets). This information could include the person's name, position, contact information, or any other relevant details.
- Emergency Options: After successful RFID tag scanning and user information retrieval, the Arduino can display the emergency options and the user information on the optional display module or send them to a computer system.
- Emergency Selection: The user can select the desired emergency option using the emergency push button(s), as described in the previous response.
- Alarm Activation: Once the emergency option is selected, the Arduino triggers the alarm corresponding to the chosen emergency type.
- Data Storage to Google Sheets: When the emergency event is triggered, the Arduino sends the relevant data (timestamp, emergency type, user information) to the Google Sheets spreadsheet using the Google Sheets API and authentication tokens.
- Alarm Deactivation: After addressing the emergency situation, an authorized person can deactivate the alarm system using their RFID tag or a separate disarming mechanism.
- Emergency Response: Train college staff or emergency responders to react appropriately when the alarm is triggered based on the specific emergency option chosen.
- Maintenance and Testing: Regularly test and maintain the system to ensure its reliability. Check the functionality of RFID tags, buttons, the alarm, and the data storage to Google Sheets mechanism to prevent potential issues during critical situations.
- Education and Awareness: Conduct awareness sessions to educate college staff and students about the emergency alarm system, how to scan their RFID tags, and how to select the appropriate emergency option. Also, inform them about the data storage in Google Sheets and how their information is being used for emergency response purposes.



-- You can observe the initialization of prototype



-- You can observe the working process

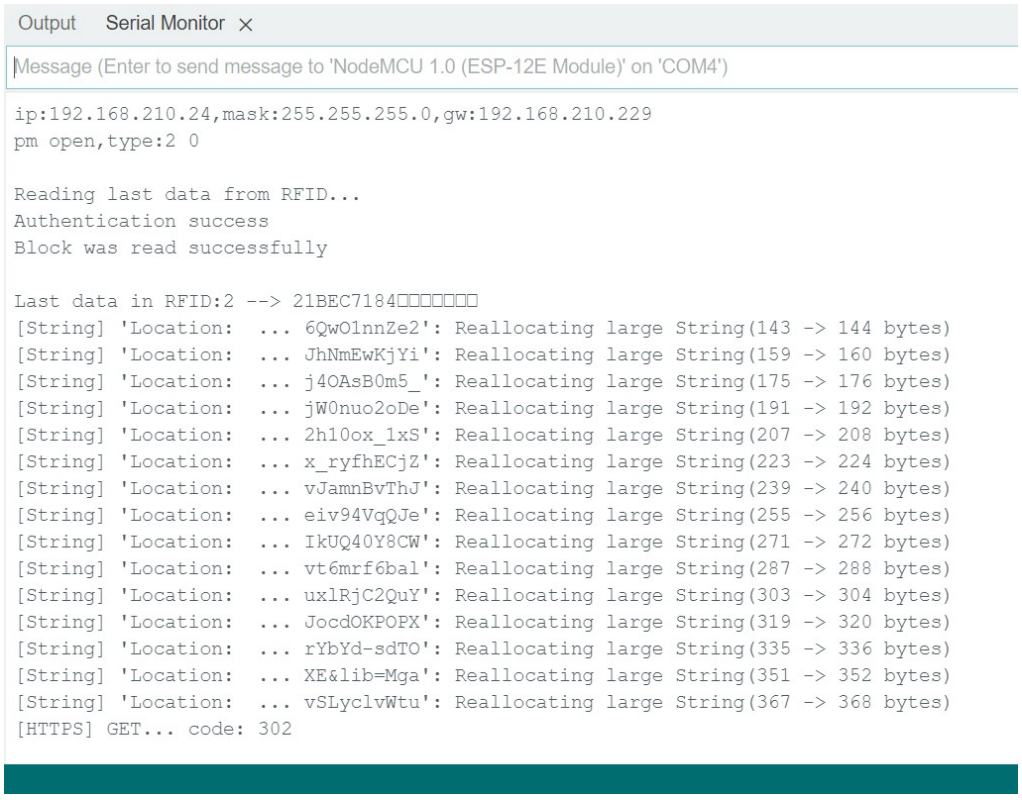
Source Code:

https://github.com/sriganesh23/RFID_alert_system

--from this source you can test and run the code.

Results & Analysis

The outcome of the RFID-based security system project is a fully operational solution that significantly elevates safety and security measures within university campuses. Through the effective utilization of RFID technology, the system successfully verifies individual identities using NIC chip cards, ensuring that only authorized personnel can engage the security alert functionalities. This streamlined process triggers security alert buttons upon verification, enabling users to promptly activate alerts during emergencies. The project's innovation lies in its seamless integration of RFID readers, NIC chip cards, security alert buttons, and walkie-talkie devices. It notably transitions from an automated box mechanism to direct button activation, simplifying system operation and enhancing user accessibility. The system further empowers emergency response by transmitting automatic voice alerts through walkie-talkie devices, promptly communicating precise location details to security personnel. Beyond its technical accomplishments, the project cultivates a culture of safety and preparedness, fostering a more secure environment within university campuses. The successful implementation of this project stands as a testament to the project team's proficiency in merging technology with safety enhancement, while also offering a blueprint for the future development of automated security solutions.



Output Serial Monitor ×

Message (Enter to send message to 'NodeMCU 1.0 (ESP-12E Module)' on 'COM4')

```
Reading last data from RFID...
Authentication success
Block was read successfully

Last data in RFID:2 --> 21BCE9548□□□□□□□
[String] 'Location:  ... 1394AX5qPU': Reallocating large String(143 -> 144 bytes)
[String] 'Location:  ... plNmEwKjYi': Reallocating large String(159 -> 160 bytes)
[String] 'Location:  ... 57Yurlwm5_': Reallocating large String(175 -> 176 bytes)
[String] 'Location:  ... jW0nuo2oDe': Reallocating large String(191 -> 192 bytes)
[String] 'Location:  ... 2h10ox_1xS': Reallocating large String(207 -> 208 bytes)
[String] 'Location:  ... x_ryfhECjZ': Reallocating large String(223 -> 224 bytes)
[String] 'Location:  ... vJamnBvThJ': Reallocating large String(239 -> 240 bytes)
[String] 'Location:  ... eiv94VqQJe': Reallocating large String(255 -> 256 bytes)
[String] 'Location:  ... IkUQ40Y8CW': Reallocating large String(271 -> 272 bytes)
[String] 'Location:  ... vt6mrf6bal': Reallocating large String(287 -> 288 bytes)
[String] 'Location:  ... uxlRjC2QuY': Reallocating large String(303 -> 304 bytes)
[String] 'Location:  ... JocdOKPOPX': Reallocating large String(319 -> 320 bytes)
[String] 'Location:  ... rYbYd-sgvq': Reallocating large String(335 -> 336 bytes)
[String] 'Location:  ... gw&lib=Mga': Reallocating large String(351 -> 352 bytes)
[String] 'Location:  ... vSLyclvWtu': Reallocating large String(367 -> 368 bytes)
[HTTPS] GET... code: 302
```

ECS 2 RFID data - Google Sheets

docs.google.com/spreadsheets/d/1YOpzQaSYlueJz4ia9RB6d2zn_Q3kytgx7e2LQLb3fPo/edit#gid=0

ECS 2 RFID data

File Edit View Insert Format Data Tools Extensions Help

Share

C189 | 21BCE9548

	A	B	C
174	8/4/2023	11:52:28	
175	8/9/2023	13:23:34	21BEC7077
176	8/9/2023	13:26:07	
177	8/9/2023	13:26:23	21BEC7077
178	8/10/2023	19:40:48	Tom
179	8/10/2023	9:46:28	
180	8/10/2023	23:00:50	21BEC7085
181	8/10/2023	23:01:03	21BEC7085
182	8/10/2023	23:01:40	21BEC7085
183	8/10/2023	23:02:42	21BEC7085
184	8/10/2023	23:02:49	21BEC7085
185	8/10/2023	23:03:29	21BEC7085
186	8/10/2023	23:06:01	
187	8/10/2023	23:08:03	
188	8/10/2023	23:20:28	21BEC7184
189	8/10/2023	23:21:19	21BCE9548
190			
191			

Sheet1

Explore

Search

ENG IN 23:23 10-08-2023

Future Scope

- Further, we can update this device as an emergency alert system by sending a voice message through voki toki which will direct to the guards without any third-person appearance also we can use an alternative accessing fingerprint device instead of RFID technology.
- We can implant this new technology in Universities, Offices, industries, and any work area with a huge population.
- Integration with Campus Security Infrastructure: The project can be extended to integrate with existing campus security systems, such as surveillance cameras, access control systems, and emergency response plans. This integration could provide a holistic approach to campus security.
- Advanced Alert Mechanisms: While the project focuses on walkie-talkie alerts, exploring additional alert mechanisms like SMS, mobile apps, or automated emails could enhance the system's reach and effectiveness.
- Data Analytics and Insights: Collecting and analyzing data from security alerts could provide valuable insights into emergency patterns, response times, and potential areas for further improvement in campus safety measures.
- Geolocation Tracking: Integrating geolocation tracking technologies could allow security personnel to pinpoint the exact location of the emergency, aiding in quick and accurate response.
- Machine Learning for Anomaly Detection: Implementing machine learning algorithms could enable the system to detect anomalies or unusual patterns in security alerts, enhancing threat detection capabilities.
- IoT Integration: Connecting the security system to the Internet of Things (IoT) could allow for remote monitoring and management of security devices and alerts.
- Collaboration with Emergency Services: Collaboration with local emergency services and law enforcement agencies could enable seamless coordination in case of larger emergencies or incidents that require external assistance.
- Enhanced User Interfaces: Developing user-friendly interfaces for security personnel, administrators, and end-users could streamline the management and use of the security system.
- Multi-Campus Deployment: Expanding the project to encompass multiple campuses or buildings within a university system could provide comprehensive security coverage across different locations.
- Community Engagement: Involving the university community in safety awareness campaigns and training sessions could enhance the effectiveness of the security system by encouraging responsible use and understanding.
- Integration with Smart Building Systems: Integrating the security system with smart building systems could offer enhanced automation, energy efficiency, and resource optimization.
- Public/Private Partnerships: Exploring partnerships with technology companies, security firms, or governmental bodies could provide resources and expertise to further develop and scale the system.

Conclusion

In conclusion, the RFID-based security system project presents a significant advancement in enhancing safety and security measures within university campuses. By harnessing RFID technology, the project has achieved the goal of efficient identity verification using NIC chip cards, allowing authorized users to activate security alert functionalities. The transition from an automated box mechanism to directly activating security alert buttons streamlines the system and simplifies its operation. Upon successful user verification, these buttons become operational, enabling the transmission of security alerts. The integration of walkie-talkie devices (Woki Toki) as a means of alert notification to security personnel is a notable enhancement. The automatic voice messages containing location information ensure that security guards receive prompt and relevant alerts, empowering them to respond swiftly to emergency situations. This project underscores the synergy of technology components – RFID readers, NIC chip cards, security alert buttons, and walkie-talkie devices – in constructing a comprehensive and effective security system. The resulting system not only expedites emergency response but also contributes to fostering a culture of safety and preparedness within university environments. Through successful implementation and testing, the project demonstrates the feasibility and practicality of this advanced security solution. The lessons learned and insights gained from this project pave the way for broader applications of RFID technology and automated alert systems in diverse contexts beyond university campuses, contributing to overall public safety.

Reference

- "RFID Technology and Applications" by Stephen B. Miles and Sanjay E. Sarma. This book provides a comprehensive overview of RFID technology, its applications, and implementation considerations. It covers topics such as RFID system components, protocols, and practical use cases.
- "Arduino Programming for Beginners" by Simon Knight. If you're using Arduino-compatible boards like NodeMCU, this book offers a beginner-friendly guide to programming with the Arduino IDE. It covers fundamental concepts, coding techniques, and hands-on projects.
- "ESP8266 Internet of Things Cookbook" by Marco Schwartz. This book focuses on IoT projects using the ESP8266 microcontroller, which NodeMCU is based on. It covers connecting to Wi-Fi networks, integrating sensors and actuators, and building IoT applications.
- "Voice Communication Over the Internet Using SIP" by Henry Sinnreich and Alan B. Johnston. This book provides insights into Session Initiation Protocol (SIP), which is commonly used for voice communication over the internet. While not directly focused on walkie-talkies, it could offer some guidance on voice communication protocols.
- "Wireless Communications: Principles and Practice" by Theodore S. Rappaport. For a deeper understanding of wireless communication concepts, this comprehensive textbook covers principles, technologies, and protocols used in wireless communication systems.
- RFID Journal (Website: www.rfidjournal.com). This online resource offers a wealth of articles, case studies, and news related to RFID technology and its various applications. It can provide insights into real-world implementations and industry trends.
- Arduino Forum (Website: forum.arduino.cc). The Arduino forum is a vibrant community where you can find discussions, tutorials, and project sharing related to Arduino and Arduino-compatible boards like NodeMCU.
- ESP8266 Community Forum (Website: www.esp8266.com). Similar to the Arduino forum, this community forum focuses on ESP8266-based microcontrollers and IoT projects. It's a great place to seek advice and share your progress.