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IOT Human Prison Escape Alerting System

Swara Nagpure[1], Radha Suple[2], Sweta Mane[3], Ojas Ganvir[4], Snehal Thorat[5]
Electronics and Telecommunication Department, Government college of Engineering, Nagpur

Abstract: ***The rising incidents of prison escapes gives to requirement of a real time monitoring technique to make prisons more secure. This article discusses an IoT Human Prison Escape Alerting System that uses Radio Frequency (RF) technology along with Internet of Things to monitor events involving prisoners. This highlights the importance of a reliable system. In the proposed method, each prisoner carries an RF transmitter that sends a unique identification signal to a central monitoring unit at regular intervals. These signals are read by a device based on microcontrollers that ensures that all prisoners are inside the locked area.***

The technology sends real time messages to the IoT platform through a Wi-Fi enabled module and instantly activates local alarms with a buzzer and display unit in the event of signal loss, indicating a possible escape attempt. This enables authorities to monitor the situation remotely and respond quickly. The I2C Protocol was incorporated for effective communication between system components such as the microcontroller and display unit. The proposed approach has several advantages such as reduced human intervention, real time surveillance, reduced response time and economical deployment. The experimental results demonstrate that the technology can efficiently detect illegal exits, provide instant alarms, and improve the overall security of jails. This work presents a scalable and effective solution to the management of modern correctional facilities and can be expanded in the future with emerging technologies such as GPS tracking and AI-based surveillance.

Keywords: Internet of Things (IoT), RF-Based Tracking, Prison Security, Real-Time Monitoring, Microcontroller Systems, Intrusion Detection, Wireless Sensor Networks.

I. INTRODUCTION

Despite this startling reality, jail escapes do occur frequently. We have all heard about and will continue to hear about a variety of jail escapes occurring worldwide, however, there is no precise data count. It is unsettling that there might still be a large number of prisoners. Here, we propose an IOT-based prisoner monitoring system that quickly notifies authorities of jail infractions. The system uses radio frequency technologies and a microcontroller-based circuit to perform the task. We utilize the RF trackers that each prisoner has to identify their presence on the property. The two central monitoring units keep a close eye on every prisoner, scanning through all of them using data that is sent to them. Every prisoner has an RF tracker that electronically sends a distinct prisoner's code. The centralized system cannot receive a prisoner's code once they depart the facility. The controller is then alerted by the receiving circuitry to take action against that particular prisoner. The system now sends the prisoner's information to the officers' alerting site to send out an instant alert and capture the inmate before he escapes even fifty meters from the institution. Here, we use Blynk IoT to create an online alerting portal system that can collect data from monitoring devices, sound alarms, and display warnings via the internet.

II. LITERATURE REVIEW

Security and surveillance systems have significantly improved with the growth of wireless communication and Internet of Things (IoT) technologies. Traditional jail monitoring methods, such as closed-circuit television(CCTV), human patrolling, and access control systems, have disadvantages despite being widely used. These include delayed response times, a significant reliance on personnel, and possible operational breakdowns. To enhance surveillance, researchers have investigated the use of Radio Frequency (RF) technology to follow individuals in confined areas. RF-based solutions enhance real-time monitoring by enabling continuous presence detection through the transmission of unique identification signals to a central receiver. However, these systems sometimes lack remote accessibility and sufficient alert mechanisms, which restricts their effectiveness in large-scale applications Wireless Sensor Networks (WSNs) have also been used for perimeter security by detecting motion or manipulation. Although they improve detection accuracy, issues such as high power consumption, difficult maintenance, and subpar real-time
visualization remain significant barriers.

IoT integration has improved surveillance systems by providing real-time data transfer, remote monitoring, and quick alarm generation using cloud platforms and online interfaces. Although GPS and GSM technologies provide accurate position tracking, they are more expensive, consume more power, and raise some privacy concerns.

Overall, research suggests that a hybrid approach that integrates RF and IoT technology provides a more cost-effective and efficient choice. This integration is the foundation of the proposed jailbreak monitoring system, which ensures continuous monitoring, real-time alerts, and improved system reliability.

III. METHODOLOGY

A. *System Overview*

1) The system uses RF transmitters attached to prisoners and a centralized receiver, to continuously monitor the presence of prisoners on prison premises.
2) A microcontroller processes the RF signals and if a signal is missing, it is possible that there is a break out from the prison or an unauthorized exit.
3) Once detected, the system sends an immediate buzzer, display and IoT platform alert, allowing authorities to monitor in real-time and respond quickly.

B. *Working Principle*

1) Each prisoner is equipped with an RF transmitter that is constantly transmitting a unique ID signal.
2) A central RF receiver collects the signals and transmits them to the microcontroller for processing.
3) The microcontroller constantly compares incoming signals with the data on prisoners stored inside it, to verify their presence.
4) If any signal is lost or not detected, the system assumes it as an escape attempt.
5) The system then triggers alerts (buzzer, display, IoT notifications) for immediate action by authorities.

C. *Software Flow*

1) Power-up system components Load prisoner ID database
2) Constantly receive the RF signals and observe.
3) Compare received signals with the stored data.
4) Detect missing signals as possible escape attempt.
5) Trigger alerts and send notification to IoT platform.

D. *Working Layout*

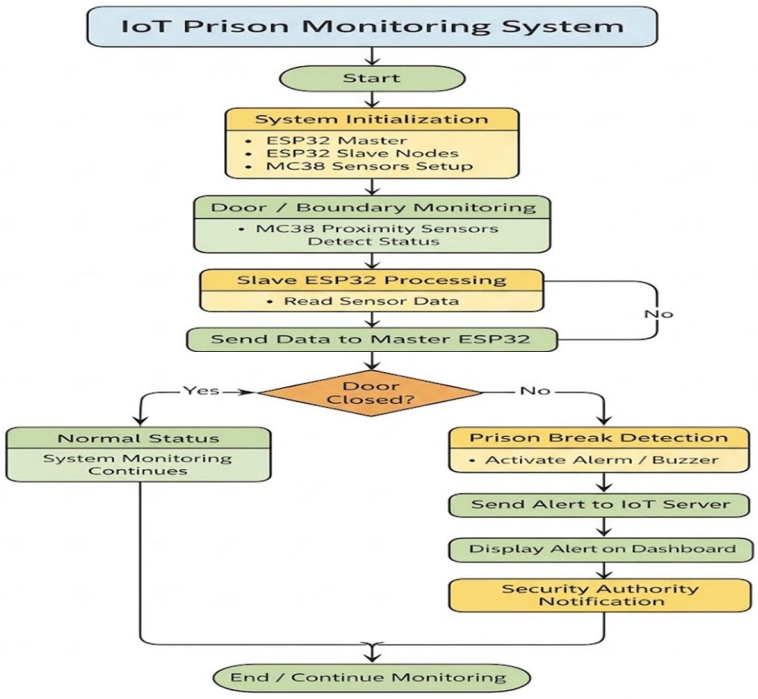

Fig. 1 IOT Prison Monitoring System – Algorithm Flowchart

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IV. RESULT AND DISCUSSION

RF technology is expected to be used by the proposed IoT Human Prison Escape Alerting System to continuously monitor the presence of inmates' on prison grounds. The system will typically indicates a safe status once all RF signals are identified. If a prisoner attempts to escape, the microcontroller immediately identifies the loss of the proper RF transmission. The system simultaneously provides instant notifications through a buzzer and LCD display and conveys messages to authorities via the Internet of Things platform. This technology is expected to improve overall jail security, minimize response times, increase surveillance efficacy, and reduce human intervention through real-time monitoring and alert creation.

TABLE I
PHYSICAL LAYERING AND SENSING MECHANISM

Feature	MC-38 Specification	Technical Implication
Switch Type	Normally Closed (NC)	Ensures a fail-safe trigger, circuit break initiates alarm.
Operating Voltage	≤ 100 V DC	Compatible with ESP32's 3.3V logic levels.
Max Current	0.5 A	Low current draw minimizes power consumption on slave node.
Sensing Gap	15 – 25 mm	Precise detection of unauthorized door opening.
Service Life	≥ 1,000,000 cycles	High durability for high-traffic entry points.

V. APPLICATIONS

1) The primary application of this technology is the real-time surveillance of cell doors and windows in correctional facilities to detect unauthorized movement.
2) It may also be expanded into a more complete asset monitoring and geofencing system by providing the inmates with non-detachable wearable slave units that sound alarms if they leave the designated secure regions.
3) The system is ideal for home security automation and domestic anti-theft solutions outside correctional settings due to its low cost and lightweight design.
4) The development of a "Smart Penitentiary" infrastructure, which integrates several sensors into a centralized, automated monitoring dashboard for enhanced public safety, ultimately depends on this architecture.

VI. CONCLUSION AND FUTURE SCOPE

The recommended IoT-based jail Break Monitoring and Alerting System is a reliable and efficient solution for increasing the jail security. By fusing RF/Wi-Fi technology with the IoT, the system ensures continuous prisoner monitoring and timely detection of escape attempts. By allowing authorities to respond quickly, the real-time alert system reduces danger and improves overall surveillance. Additionally, the system lowers human intervention and offers a scalable, cost-effective way to manage modern prisons.

The integration of the Internet of Things (IoT) into the design of correctional facilities has resulted in a substantial change from traditional, human-centred surveillance to autonomous, sensor-driven oversight. To address the persistent issues of perimeter breaches and unauthorized inmate mobility, distributed embedded technologies are becoming increasingly crucial in contemporary jail administration. The system under investigation in this study combines a master-slave architecture with ESP32 microcontrollers integrated with MC-38 magnetic reed sensors to create a real-time warning network.

This technological synthesis evaluates the performance of the configuration, provides a comprehensive future scope for the next generation of smart jail security, and derives significant conclusions from testing data. The current prototype is an initial stage in the development of a "Smart Penitentiary Facility." The future scope of this project involves merging distributed ledger technology, artificial intelligence, and advanced communication protocols to create a completely autonomous security environment. The main limitations of the system are the short range and poor penetration of the 2.4 GHz signal. In furture generations, the master-slave link will either be improved or replaced with LoRa (Long Range) technology.

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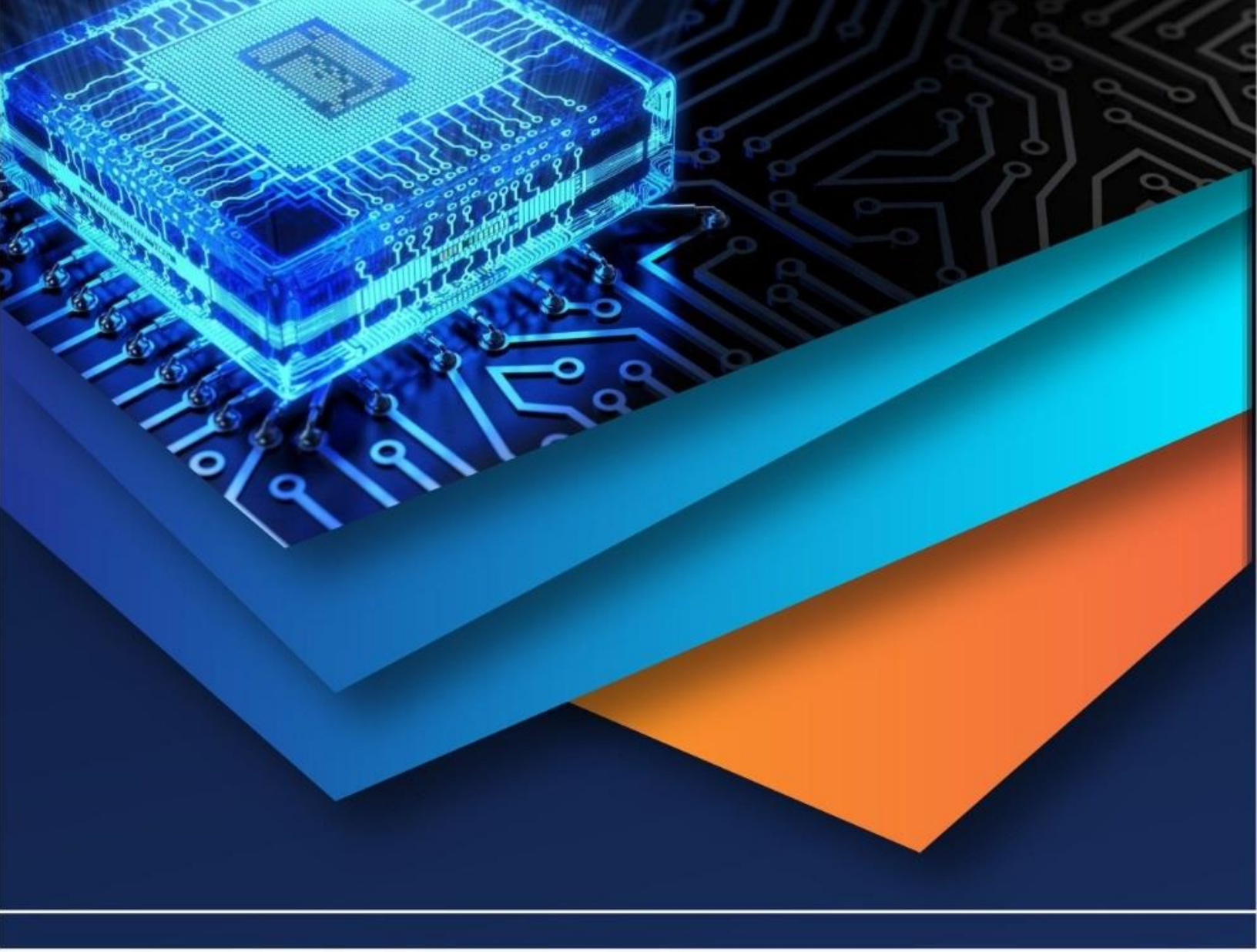

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