iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** III **Month of publication:** March 2025

DOI: https://doi.org/10.22214/ijraset.2025.67833

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue III Mar 2025- Available at www.ijraset.com

Tracking Personnel using NFC Devices: A Study on the Feasibility and Benefits

S Sudhip, Pratyush Sthapit, Sanya Maheshwari, Samarjit Sahu, Akshat Verma
School of Computer Science and Information Technology, Jain Deemed-To-Be University

Abstract: ***In today's fast-paced world, tracking personnel has become a necessity for various organizations, especially in industries such as Police Department, and security. The use of Near Field Communication (NFC) devices has emerged as a promising technology for tracking personnel. This paper presents a study on the feasibility and benefits of tracking personnel using NFC devices.***
Our study is based on NFC (Near Field Communication) which is A wireless communication technology that allows two devices to Exchange data when they are brought into proximity.
NFC when used in reader/writer mode NFC device can read From NFC transponders or NFC writer. NFC when used in peer-To-peer mode NFC can be used to exchange information Between two NFC enabled devices and in card emulation mode NFC device can be used with Contactless Card for various Purposes like paying money or exchanging information Security of NFC device can be ensured by various means of Encryption and now we have new web3 technology.

I. INTRODUCTION

The experiment involves equipping personnel with NFC- enabled ID badges, which were scanned at different Checkpoints throughout the Event location. The data collected Will be analyzed to determine the feasibility of tracking Personnel using NFC devices, as well as the benefits that can Be achieved.
The results of the study showed that NFC technology Is a feasible and effective way of tracking personnel. The use Of NFC devices resulted in improved efficiency, reduced Errors, and enhanced security. The data collected allowed for A better understanding of personnel movement, which can be Used to optimize staffing levels and improve workflow The Study also identified some challenges associated with the Implementation of NFC technology, such as the need for Appropriate training and maintenance of the devices.
However, the benefits of using NFC technology far outweighed the challenges, making it a viable option for tracking Personnel.
This paper concludes that the use of NFC technology for tracking personnel is a promising approach that can Benefit various industries. The study recommends that Organizations adopt NFC technology for personnel tracking to Achieve improved efficiency, reduced errors, and enhanced Security.
This paper also explores the feasibility and benefits of implementing NFC-based personnel tracking systems in various sectors. The study delves into the technical requirements, security considerations, and potential challenges associated with NFC deployment, as well as the advantages it offers, including enhanced security, productivity, and cost-effectiveness. Through this research, we aim to assess the viability of NFC technology as a solution for modern workforce management.

A. Project Problem Statement and Motivation

The central challenge addressed by this study is the inadequacy of existing personnel tracking systems in meeting the evolving demands of modern organizations. Current solutions often encounter issues related to accuracy, real-time data availability, user privacy concerns, and high implementation costs. These shortcomings can lead to operational inefficiencies, compromised safety, and increased security risks. This research aims to design and implement an NFC-based personnel tracking system that overcomes these limitations by offering precise, instantaneous tracking capabilities while ensuring data privacy and cost- effectiveness.
The motivation for this study stems from the potential of NFC technology to revolutionize personnel tracking practices. NFC's attributes—such as low power consumption, ease of integration with mobile devices, and inherent security features—render it an ideal candidate for developing robust. tracking systems. By leveraging NFC, organizations can achieve enhanced operational efficiency through accurate monitoring of personnel movements, leading to optimized resource allocation and improved safety protocols. Furthermore, the ability to ensure data privacy and comply with security regulations positions NFC-based tracking as a forward-thinking solution aligned with contemporary technological advancements.

B. Project Objectives

Tracking personnel has become a crucial aspect of any organization in various industries. The need for Tracking personnel arises from the need to improve Efficiency, reduce errors, and enhance security. In Industries such as Police Department, security, and Manufacturing, tracking personnel is critical to ensure Optimal functioning and productivity.

Our project is going to solve these problems by using NFC technology. Near field communication (NFC) is an Automatic identification method, relying on storing and remotely retrieving data using devices called NFC tags or Transponders. So, the NFC is a wireless identification Normally the NFC system comprises of two main parts Are NFC Reader and NFC Tag.

Near Field Communication (NFC) is still a Developing technology which can be used to Revolutionize tracking Personnels in Police Department. NFC is still being developed and can be used for various purposes. Data that will be collected from NFC readers through NFC Writer will be used to track the Movement of Police Personnels in Events or festivals.

Modern technologies like NFC, wireless, Bluetooth, Robot are developed, and many modern technologies are being Developed in a developing country like ours. Therefore, these Technologies can be to ensure the employee time in/out, to Track the location of the staff at specific location at workplace During work hour. In addition to creating an efficient system That automatically records and updates the location of the Employee in real-time, this system helps the administration, Managers, or boss to monitor and their employees Immediately from the record in the database. This will allow Its manager, boss, or supervisor to see changes as soon as they Occur, rather than waiting for updates to be visible later.

The purpose of this project is to solve the problems That arises when the personnel are not present at their Allocated location which leads to unavoidable circumstances Which could be avoided. This system implemented because Wasting time, energy and fuel of higher authorities is not an innovative idea.

Additionally, the research intends to identify and scrutinize the inherent challenges and constraints associated with the implementation of NFC-based personnel tracking systems. This includes an examination of technical limitations, potential impediments during deployment, and factors influencing user acceptance. Furthermore, the study aims to explore prospective enhancements and future developments in NFC-based tracking frameworks by integrating emergent. technologies such as the Internet of Things (IoT) and artificial intelligence (AI) to improve precision, automation, and scalability.

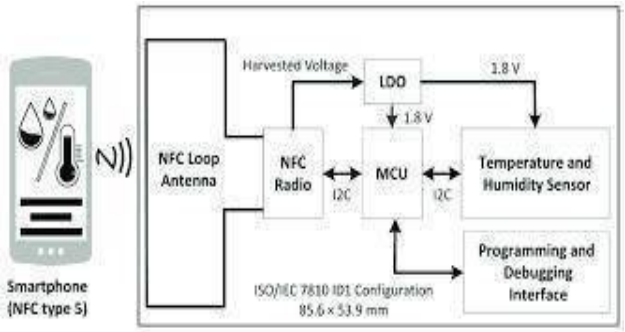


Fig 1.1 Usage of NFC

C. Scope of the Project

This research focuses on developing and evaluating a Near Field Communication (NFC)-based system for real-time personnel tracking within organizational environments, including corporate offices, industrial facilities, and high- security areas. The project involves designing an NFC- enabled tracking system that ensures data privacy, security compliance, and user-friendly operation. The study will assess the system's impact on operational efficiency, security enhancement, and cost-effectiveness compared to traditional tracking methods. Additionally, potential challenges such as technical limitations, implementation barriers, and user acceptance will be examined. The research will also explore integrating emerging technologies like the Internet of Things (IoT) and artificial intelligence (AI) to enhance the system's accuracy, automation, and scalability.

The project's scope Is broken down into three primary Components: users, system operability, functionality, and System tool.

1) User Personnel

In this system, personnel would be required to register the Credentials through the application so that their data can be Stored properly into the database, which also allows them to Share their live location in a time of need.

2) Higher authority

The Higher authority is allowed to search the data of Personnel including their name and designation and the Location of personnel.

3) Administrator

For the administrator, they are important user in this system Because they allow adding, updating, deleting, viewing, and searching the data of the personnel in the database beside to Search the personnel's location.

D. Implementation

The implementation of the NFC-based tracking system follows a structured methodology that ensures optimal performance and security. The core components of the system include NFC-enabled ID badges, strategically placed NFC readers, and a centralized database. These elements work together to facilitate seamless personnel tracking and data transmission.

1) System Architecture

The system architecture integrates NFC-enabled ID badges with strategically positioned NFC readers. When personnel scan their badges at designated checkpoints, real-time data is transmitted to a centralized database, ensuring accurate tracking with minimal human error. A user-friendly web or mobile interface enables real-time monitoring and data analysis. The centralized database is designed to manage high volumes of real-time data, ensuring efficient storage and retrieval of personnel tracking logs. Advanced query processing mechanisms allow authorized personnel to generate reports and analyze workforce movement trends. To enhance system resilience, cloud-based storage solutions are considered, ensuring data accessibility even in the event of localized system failures.

2) Security Measures

Security is a critical aspect of the system. Encryption protocols are implemented to safeguard data transmission, preventing unauthorized access or manipulation. Additionally, access control mechanisms ensure that only authorized personnel can view and manage tracking data, with hierarchical access rights assigned based on roles and responsibilities. Multi-factor authentication (MFA) is incorporated to enhance security, preventing unauthorized alterations to tracking records. Periodic security audits are conducted to identify potential vulnerabilities. The system is designed to comply with industry standards such as the General Data Protection Regulation (GDPR) and ISO/IEC 27001, ensuring that data privacy and security remain a priority.

3) Integration with Workforce Management Systems

The system seamlessly integrates with existing workforce management solutions, synchronizing attendance records and administrative platforms. This integration allows for enhanced workforce analytics, enabling organizations to optimize personnel deployment and improve operational efficiency. By analyzing historical tracking data, businesses can identify patterns and make informed decisions regarding workforce allocation, shift management, and security protocols.

4) Scalability and Future Enhancements

The system is designed with scalability in mind, incorporating provisions for advanced technologies such as the Internet of Things (IoT) and Artificial Intelligence (AI). These enhancements facilitate predictive monitoring, automated alerts for unauthorized movements, and improved workforce optimization. IoT-enabled NFC readers enhance accuracy by reducing scanning failures, while AI-driven analytics provide deeper insights into personnel movement trends. Future iterations of the system may incorporate blockchain technology to ensure tamper-proof record-keeping. Blockchain-based tracking logs would enhance transparency and trust, preventing unauthorized alterations to personnel tracking records. Additionally, machine learning algorithms could be employed to predict employee behavior, optimizing workforce planning and resource allocation.

E. Methodology

The research methodology follows a structured, multi-phase approach to evaluate the feasibility and effectiveness of NFC technology in personnel tracking.

1) Preliminary Research

The initial phase involves an in-depth analysis of existing personnel tracking methods, identifying common drawbacks such as inefficiencies, security vulnerabilities, and inaccuracies. This research establishes a baseline for comparison and defines key objectives for the NFC-based tracking system. The study reviews case studies from various industries to assess the effectiveness of NFC technology in real-world scenarios.

2) System Design

The system design phase includes the selection of appropriate NFC-enabled devices, development of a reliable data storage solution, and creation of an intuitive user interface. Security considerations such as encryption techniques, access control protocols, and data privacy measures are prioritized to ensure compliance with industry standards. Additionally, user experience (UX) testing is conducted to ensure that the interface remains intuitive and efficient for personnel and administrators.

3) Prototype Development

A prototype is developed and deployed in a controlled environment. Personnel movement is monitored using NFC check-ins at designated checkpoints. Data collected during this phase is analyzed to assess system accuracy, reliability, and efficiency. Performance metrics such as response time, data integrity, and scalability are evaluated. The prototype phase also includes stress testing, where the system is exposed to varying levels of personnel activity to evaluate performance under different workload conditions. System failures, latency issues, and network disruptions are documented and addressed to optimize system stability.

4) Performance Evaluation

Potential challenges, including signal interference, hardware compatibility, and user acceptance, are examined. User compliance factors such as training requirements, perceived reliability, and privacy concerns are also considered. Surveys and feedback mechanisms are employed to assess personnel perceptions of the system, ensuring that adoption barriers are identified and mitigated.

5) System Refinement and Future Enhancements

Based on user feedback and technical evaluations, the system undergoes refinement. Enhancements such as AI-driven predictive workforce management and IoT-based tracking solutions are explored to improve accuracy and operational efficiency. The goal is to develop a scalable, cost-effective, and secure workforce management solution applicable across various industries.

F. Performance Evaluation

Real-Time Monitoring and Accuracy: NFC technology enables real-time tracking of personnel, ensuring accurate and up-to-date location data. This allows for precise performance evaluation based on time logs and movement patterns.

Automated Attendance and Time Management: By using NFC tags or cards, personnel can log their attendance automatically. This eliminates manual errors and provides a reliable metric for evaluating punctuality and attendance consistency. Task Completion Tracking: NFC can be integrated with task management systems to track the completion of assigned duties. Supervisors can evaluate performance based on the timely and efficient completion of tasks. Energy Efficiency and Cost-Effectiveness: NFC technology consumes minimal power compared to other tracking systems like GPS. This makes it a cost- effective solution for long-term performance monitoring without frequent battery replacements. Enhanced Security and Accountability: NFC ensures that only authorized personnel can access specific areas or resources. This enhances accountability and allows for performance evaluation based on adherence to security protocols.

Data-Driven Insights for Improvement: The data collected through NFC tracking can be analyzed to identify patterns, such as frequent delays or inefficiencies. This provides actionable insights for performance improvement and training needs. Seamless Integration with Existing Systems: NFC technology can be easily integrated with existing HR and management systems, enabling a streamlined approach to performance evaluation without significant infrastructure changes.

Reduction in Manual Supervision: NFC reduces the need for constant manual supervision, as it automates data collection. This allows managers to focus on analyzing performance metrics rather than gathering data.

Customizable Evaluation Metrics: NFC systems can be tailored to track specific performance indicators relevant to the organization, such as time spent on specific tasks, frequency of breaks, or adherence to safety protocols.

Geofencing and Zone-Based Performance Analysis: NFC technology can be used to create geofenced zones within a workplace. Personnel movement in and out of these zones can be tracked, allowing for performance evaluation based on time spent in designated work areas.

Error Reduction in Data Collection: Unlike manual tracking methods, NFC eliminates human errors in data recording. This ensures that performance evaluations are based on accurate and reliable data.

Enhanced Productivity Measurement: By tracking the time taken to complete specific tasks or projects, NFC technology provides a clear metric for assessing individual or team productivity.

Support for Remote and On-Site Workforce: NFC can be used to track both on-site and remote personnel by integrating with mobile devices. This ensures consistent performance evaluation across different work environments.

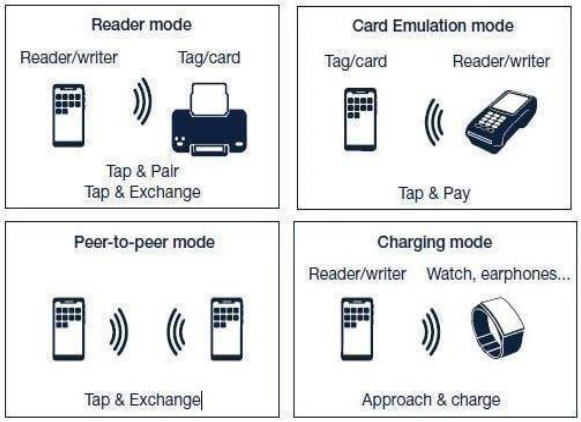


Fig 1.2

G. Challenges and limitations

Tracking personnel using NFC (Near Field Communication) technology offers numerous benefits, such as enhanced security, streamlined operations, and real-time monitoring. However, it also comes with several challenges and limitations that need to be addressed for effective implementation. Below are 8-9 key challenges and limitations of using NFC technology for personnel tracking:

1) Limited Range:NFC technology operates within a short range (typically up to 10 cm), which restricts its use in large-scale environments. This limitation makes it unsuitable for tracking personnel across expansive areas or in scenarios requiring long-distance communication.

2) Privacy Concerns: Tracking personnel using NFC raises significant privacy issues. Employees may feel uncomfortable being constantly monitored, leading to resistance or mistrust. Ensuring compliance with data protection regulations (e.g., GDPR) is crucial but challenging.

3) Security Vulnerabilities: NFC signals can be intercepted by malicious actors, leading to potential data breaches or unauthorized access. Without robust encryption and authentication protocols, sensitive personnel data could be compromised.

4) Dependence on Device Compatibility: NFC-based tracking requires employees to carry NFC- enabled devices or tags. If employees forget or lose these devices, tracking becomes ineffective. Additionally, not all smartphones or devices support NFC, limiting its universal applicability.

5) Environmental Interference: NFC signals can be affected by environmental factors such as metal surfaces, electromagnetic interference, or physical obstructions. This can lead to unreliable tracking in certain environments, such as industrial or construction sites.

6) Cost of Implementation: Deploying NFC infrastructure, including readers, tags, and software, can be expensive. Small organizations or those with limited budgets may find it challenging to adopt this technology for personnel tracking.

7) Maintenance and Scalability: Maintaining NFC systems, such as updating software, replacing damaged tags, or expanding the system for a growing workforce, can be resource-intensive. Scalability issues may arise when organizations need to track a large number of personnel simultaneously.

8) Battery Dependency (for Active NFC Tags): Active NFC tags, which have their own power source, require regular battery replacements. This adds to operational costs and can lead to tracking failures if batteries are not replaced on time.

9) Limited Data Storage: NFC tags have limited storage capacity, which restricts the amount of data that can be stored directly on the tag. This limitation may require additional backend systems for storing and processing personnel data, increasing complexity.

10) In conclusion, while NFC technology offers a convenient and efficient way to track personnel, its limitations—such as range constraints, privacy concerns, and environmental interference—must be carefully considered. Addressing these challenges through proper planning, robust security measures, and employee engagement is essential for successful implementation

II.SYSTEM ARCHITECTURE

The NFC system consists of three main components: NFC tags, NFC readers, and a backend server. Each component plays a distinct role in ensuring secure and reliable communication.

A. NFC Tags

NFC tags are passive devices that store data and respond to queries from NFC readers. These tags consist of a microchip and an antenna embedded within a compact form factor. Memory Structure: NFC tags store a unique identifier (UID) and additional user-defined data (e.g., product details, transaction history).
Power Source: NFC tags are powered by the electromagnetic field generated by the NFC reader through inductive coupling.
Types of NFC Tags: NFC tags are classified into four types based on memory size, communication speed, and functionality:
Type 1: Simple read/write; limited memory. Type 2: Improved speed and memory compared to Type 1. Type 3: High-speed data transfer; suitable for complex applications.
Type 4: Secure and configurable; used for payment and authentication.

B. NFC Readers (Initiators)

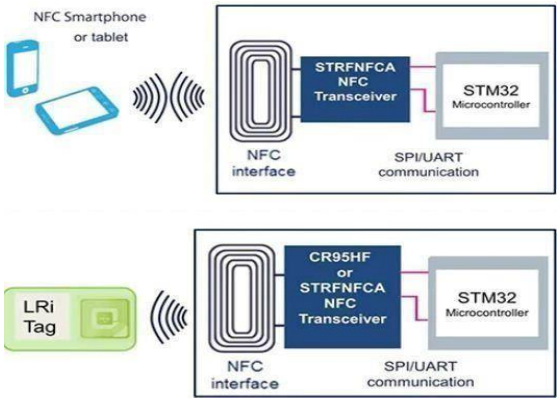
NFC readers are active devices that generate a high-frequency magnetic field to communicate with NFC tags. They serve as the initiator of the communication process.
Frequency: Operates at 13.56 MHz.
Communication Role: Initiates communication by generating an RF field and decoding the tag's response.
Types of NFC Readers:
Integrated into smartphones.
Standalone POS (Point of Sale) terminals.
Access control systems.

C. Backend Server

A backend server is used to store, process, and manage data retrieved from NFC tags. While not mandatory for NFC communication, it is essential for large-scale tracking and management systems.
Data Storage: UID and associated metadata are logged and processed.
Authentication: Verifies the UID and ensures data integrity. Communication: Data is exchanged with the NFC reader over a secure network.

II. COMMUNICATION PROTOCOLS

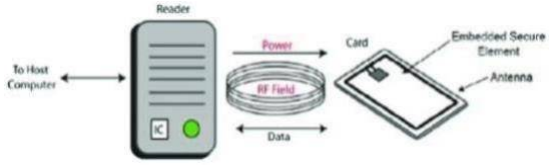
NFC communication is based on two key standards: A.ISO/IEC 14443
Defines the communication protocol between proximity cards and readers.
Supports data rates of 106 kbps, 212 kbps, and 424 kbps. Uses polling, where the reader sends a command, and the tag responds.
B.ISO/IEC 18092
Governs peer-to-peer communication between two active NFC devices.
Uses a half-duplex mode for bi-directional data exchange.
Supports data rates of up to 424 kbps.



III. OPERATIONAL MODES

NFC operates in three distinct modes, depending on the role of the device involved in the communication process:

1) Reader/Writer Mode: The NFC device acts as a reader to retrieve data from an NFC tag. Example: Reading product information from an NFC- enabled label.
2) Card Emulation Mode: The NFC device emulates a contactless smart card. Example: Mobile payment through Google Pay or Apple Pay.
3) Peer-to-Peer Mode: Two active NFC devices establish a communication channel to exchange data directly. Example: File sharing between smartphones.



IV. WORKING PROCESS

The working process of NFC can be summarized into three phases:

1) *Initiation and Activation*

- The NFC reader generates an electromagnetic field at 13.56 MHz
- The NFC tag absorbs energy through inductive coupling, activating the internal microchip.

2) *Data Exchange*

- The tag responds with its UID and stored data using amplitude shift keying (ASK).
- The reader decodes the signal and transmits the data to the backend server (if applicable).
- Peer-to-peer communication follows a half-duplex model, where each device takes turns transmitting data.

3) *Authentication and Processing*

- The UID is matched with backend server records for verification.
- Once authenticated, the system processes the request (e.g., payment authorization).
- The communication session terminates after data exchange is complete.

VI.SECURITY MECHANISMS

NFC includes several built-in security features to protect data integrity and prevent unauthorized access:

1) Short Range: The limited communication range reduces the risk of interception.
2) Encryption: Data is encrypted using secure communication protocols (e.g., AES).
3) Mutual Authentication: Both the NFC reader and tag authenticate each other before exchanging data.
4) Secure Element (SE): A hardware chip used to store sensitive data and handle secure transactions.

VII.PERFORMANCE METRICS

A. *Parameter Value*

Operating Frequency	13.56 MHz
Communication Range	≤ 4 cm

Parameter	Value
Data Transfer Rate	106 kbps, 212 kbps, 424 kbps
Power Consumption	Low
Security	Encryption, Mutual Authentication

B. Future Trends in NFC Asset Tracking

1) Integration with IoT

NFC is increasingly being integrated with IoT (Internet of Things) systems, enabling seamless data exchange between devices and centralized platforms.

2) Enhanced Security

Advances in encryption and authentication protocols are making NFC even more secure for sensitive applications like healthcare and finance.

3) Hybrid Solutions

NFC is being combined with other technologies (e.g., Bluetooth, GPS) to overcome its range limitations and provide more comprehensive tracking solutions.

4) Smart Packaging

NFC tags are being embedded in product packaging to provide consumers with additional information (e.g., origin, ingredients) and enable interactive experiences.

C. Schematics of the NFC Tracking App for Police Personnel

The proposed NFC tracking application implementation for police service members enhances professional efficiency and guarantees officer safety through automated communication between frontline staff and HQ facilities. This app implements three options: NFC (Near Field Communication) technology, biometric verification protocols and real-time tracking features to establish an advanced system for police activity monitoring and management. The following document shows a detailed scheme describing application functionality and this section provides extensive analysis on program creation as well as feature descriptions.

D. Core Functionality

The application base functions include real-time tracking in addition to officer status reporting and emergency SOS alerts and HQ and fellow officer communications. The tracking function will operate based on both GPS signals and NFC wireless communication technology. During movement officers enable GPS to monitor their genuine-time positions. NFC tags will function as loggers for officer presence within particular areas alongside their checkpoints. The tracking system uses multiple methods simultaneously to offer precise results since it operates effectively when officers are either on patrol or working in a fixed location. Depending on their assignments officers must use their NFC tags for check-in at set checkpoints before proceeding with check-out by tapping again to log into new checkpoints. The system maintains real- time awareness of all officers' locations at HQ.

Officer status updates form an essential part of the app functionality which enables personnel to change their status between "On Duty," "On Break" and "In Pursuit" and have HQ and fellow officers see those updates. Each participant's real time status becomes accessible to all users through this feature thus enabling safe operation coordination between them. The application will contain an SOS button that officers can activate during emergencies. Not check in HQ gets notified which allows for proper action to be initiated. The system implements continuous officer verification which helps keep HQ informed about personnel locations ensuring their protection when out of sight from their base. Biometric authentication technologies will be fundamental for maintaining officers' responsibility. The app only permits authorized personnel entry to its features through a biometric- based verification process of police officers. The app implements features which stop unauthorized access and guarantee protection of sensitive information. A complete law enforcement monitoring system occurs through real-time tracking, NFC check-ins and biometric identity verification which ensures officers remain tracked and in safe conditions.

E. Technical Aspects

The application development process will result in native code for running on both Android smartphones and iOS mobile devices. Native app development delivers optimal performance excellence that matches mobile devices for delivering a smooth user experience. The tool operates independently and avoids database and dispatch system integration since it exists as a separate communication tool. The developers chose a simple development approach to enable fast deployment of the app which does not require connecting to existing systems. Users will be able to access the application offline to maintain tracking functionality when mobile devices have no connectivity to the internet. Data upload is possible from the checkpoints despite officers using devices offline because they are connected to satellite links. Location and status updates will be recorded at all times by the system because offline functionality is supported. The app design supports expansion plans even if future development needs exceed its current audience requirements yet the main emphasis remains on delivering appropriate functionality for the first users.

F. Development and Features of the Demo App

The demo application development will deliver core functions while advancing toward a usable prototype which can undergo testing and enhancement activities. The planned development follows an organized system through creating an elaborate project plan until deploying the demo app for inspection.

The application backend will implement storage features and programming which enables NFC tag reading and sends data to satellite-linked checkpoints. The backend system maintains control over biometric verification through which it authenticates authorized users to access the app. Native programming languages of Java/Kotlin for Android and Swift for iOS will power the frontend development to build an interface which officers can use efficiently for accessing features of the app.

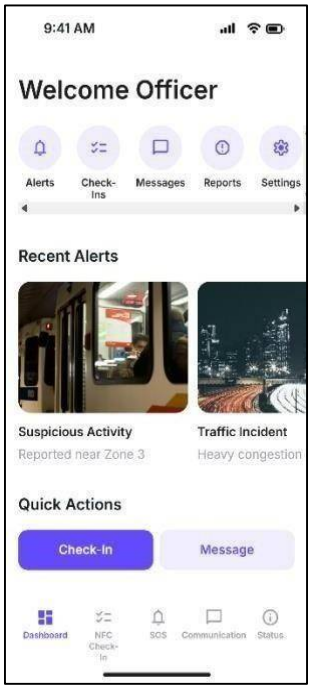
The application will utilize NFC technology as a system enabling police personnel to both enter and exit checkpoint areas. The future development of the app will transform both tag and reader functions into mobile devices thus eliminating dependency on separate hardware units. The testing phase for the demo app will pursue comprehensive testing to detect and resolve all system bugs before full deployment. Testing feedback from users will help improve both the usability features and develop the functional aspects of the application. Police operators will execute testing of the demo application through limited personnel deployment. A thorough monitoring system will monitor the application to verify its user needs and operational capabilities.

G. Explanation of the NFC Tracking App for Police Personnel

The NFC tracking app designed for police personnel serves three main functions which boost operational efficiency and protect officers while enabling HQ communications with field units. A robust system for police activity monitoring exists because the app utilizes NFC (Near Field Communication) technology with biometric authentication and real-time tracking as well as communication features. The app functions according to the details outlined in this report which uses the screens and features to explain user experience and technical architecture.

1) Biometric Authentication Screen

A biometric authentication screen operates as the first interface which lets only authorized users access the application features. Fingerprint scanning or facial recognition verifies officers depending on their mobile device's abilities. Security measures employed at the app entry point protect sensitive operational information from unauthorized users. A manual entry process to input credentials exists as a backup system but simultaneously generates instant notifications to HQ whenever this occurs for documentation purposes. After successful authentication the officer receives control over the Dashboard which stands as the primary interface of the app.



2) Dashboard (Home Screen)

The Dashboard serves as the primary interface, combining real-time data visualization and quick-access controls. Its layout is designed for simplicity while prioritizing critical information:

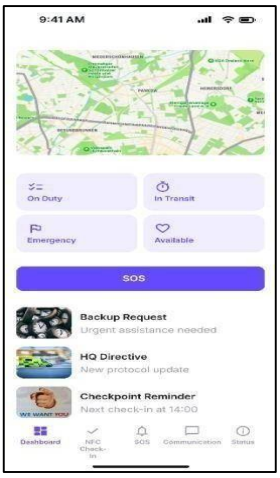
Live Map View: A GPS-integrated map displays the officer's current location and nearby NFC checkpoints. Checkpoints are marked with color-coded icons (green for active, red for inactive).

Officer Status Panel: A floating window shows the officer's current status (e.g., "On Duty," "In Transit," "Emergency"). A dropdown menu allows quick status updates.

SOS Button: A large, red button is fixed at the bottom-right corner for one-tap emergency alerts. Pressing it triggers an immediate notification to HQ and nearby officers, sharing the officer's GPS coordinates and checkpoint history.

Recent Alerts: A scrollable sidebar lists recent push notifications (e.g., backup requests, HQ directives, checkpoint reminders).

Navigation Bar: Provides shortcuts to key modules: NFC Check-In, Communication, Status Updates, and Settings.



3) NFC Check-In Interface

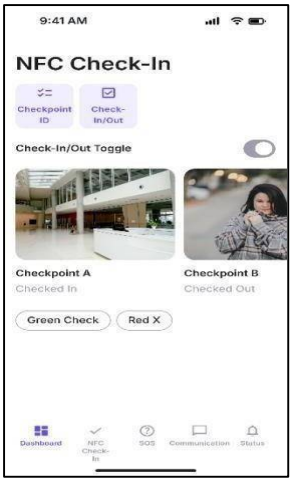
The page offers a platform to log locations through NFC technology. The interface becomes available for an officer to touch their NFC tag (or smartphone) against the checkpoint reader upon their arrival. The software application uses the detected tap to modify the officer's location information in the database. Key elements include:

Checkpoint ID: Displays the name or code of the last scanned checkpoint.

Check-In/Check-Out Toggle: Officers manually toggle between logging into a new checkpoint or logging out of the current one.

Timestamp History: A log of recent check-ins/check-outs, synced with HQ via satellite even in offline mode.

Visual Confirmation: A green checkmark appears upon successful scan, while a red "X" indicates errors (e.g., invalid tag, connectivity issues).



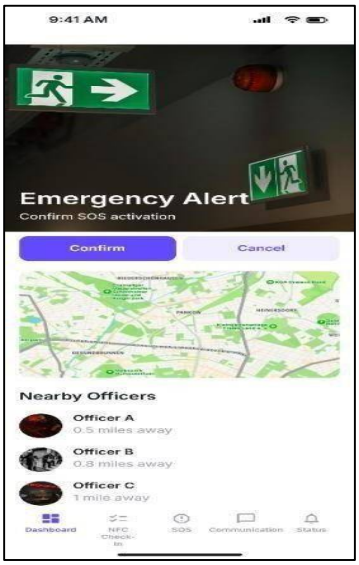
4) SOS/Emergency Page

The SOS page activates automatically when the emergency button is pressed. It includes:

Distress Signal Confirmation: A pop-up asks the officer to confirm the SOS request to prevent accidental triggers. If no response is received within 10 seconds, the alert is sent automatically.

Live Location Sharing: HQ receives continuous GPS updates until the officer manually deactivates the SOS or confirms safety.

Nearby Officers List: Displays a list of officers within a 1-mile radius, allowing the distressed officer to request direct backup.



5) Communication Module

Auto-Sync: Changes are immediately reflected on the Dashboard and shared with HQ.

This module integrates voice calls and push notifications for streamlined coordination:

Direct Voice Call to HQ: A dedicated button connects the officer to the command centre via encrypted VoIP. Call logs are stored locally and synced to the cloud when connectivity resumes.

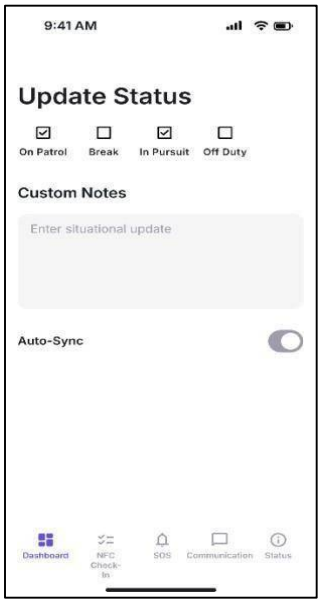
Group Broadcasts: Supervisors can send preconfigured alerts (e.g., “Area Lockdown,” “Suspect Spotted”) to all officers in a zone.

Push Notification Centre: Officers receive real-time alerts for emergencies, shift changes, or checkpoint deadlines. Notifications are prioritized by urgency (e.g., red for SOS, yellow for reminders).

6) Status Updates Page

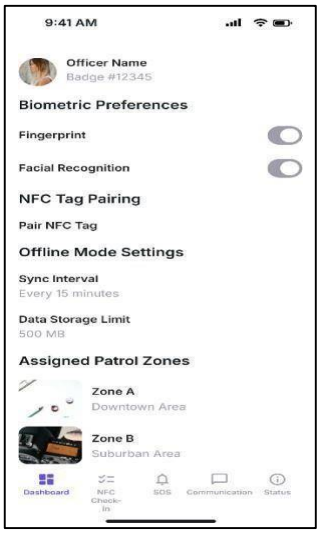
Officers use this page to manually update their operational status. Options include:
Predefined Statuses: "On Patrol," "Break," "In Pursuit," "Off Duty."
Custom Notes: A text field for brief situational updates (e.g., "Monitoring Traffic at Highway 5").
User Flow Schematic
Authentication: Officer logs in via biometric scan → Redirect to Dashboard.

a) Checkpoint Logging: Officer navigates to NFC Check- In → Taps tag at checkpoint → System updates location.
b) Status Updates: Officer selects new status from dropdown → HQ receives real-time update.
c) Emergency Protocol: Officer triggers SOS → Confirmation pop-up → HQ alerted with live location.
d) Communication: Officer initiates voice call or responds to push notifications → HQ coordinates response.
e) Logout: Officer ends shift → System logs out automatically after final checkpoint scan.



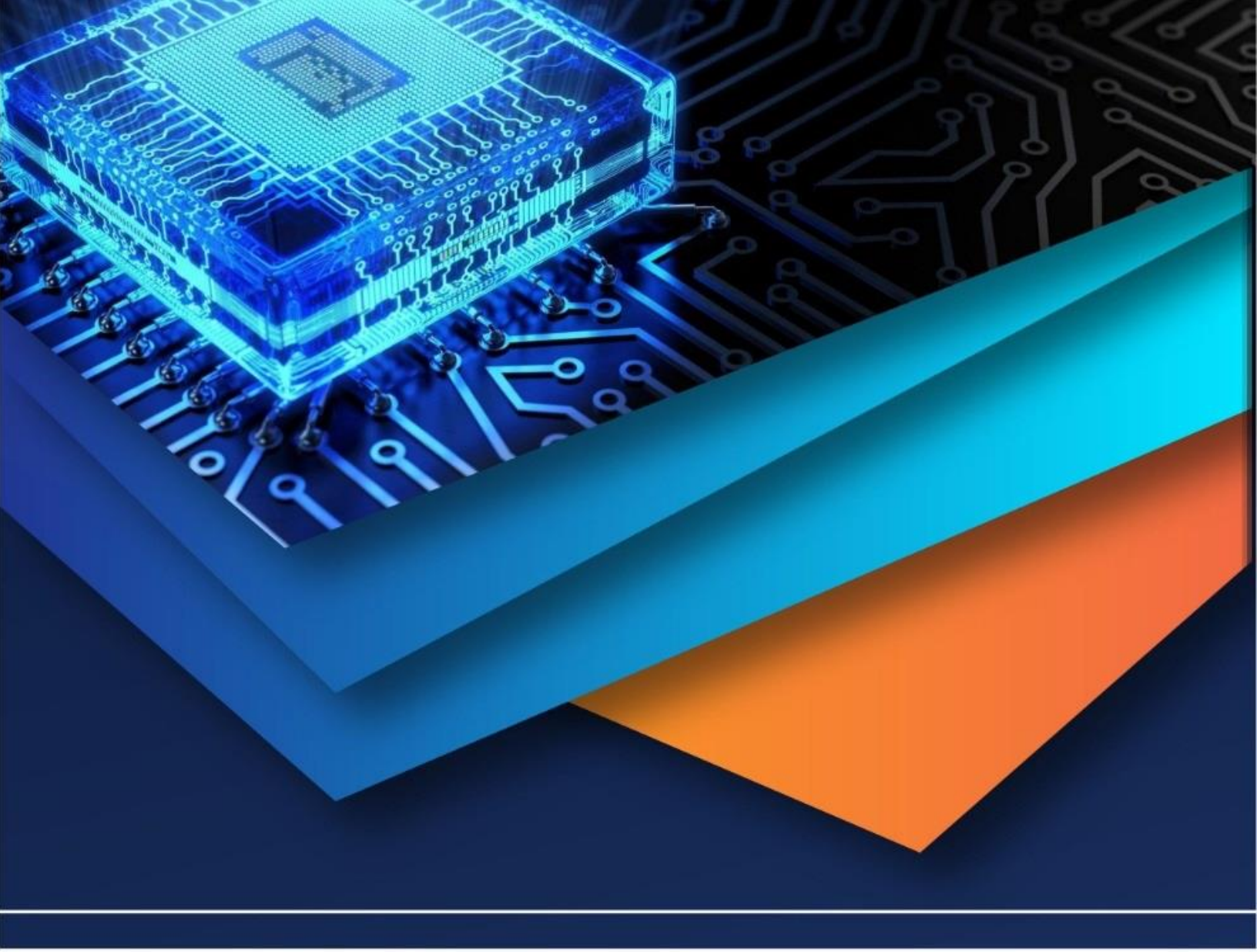
7) Settings and Profile

This section manages app configurations and officer details:
Biometric Preferences: Officers can enable/disable fingerprint or facial recognition.
NFC Tag Pairing: Links physical NFC tags to the officer's profile (for checkpoint compatibility).
Offline Mode Settings: Adjusts satellite sync intervals and data storage limits.
Profile Details: Displays badge number, rank, and assigned patrol zones.



REFERENCES

[1] https://en.wikipedia.org/wiki/Near-
[2] https://www.rfpage.com/applications-near-field-
[3] https://www.geeksforgeeks.org/near-field-
[4] https://nfc-forum.org/what-is-nfc/
[5] https://www.iso.org/standard/73598.html
[6] https://www.iso.org/standard/59678.html
[7] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32016R0679
[8] https://www.iso.org/standard/54534.html
[9] https://nfc-forum.org/specs/
[10] https://www.sciencedirect.com/topics/computer-science/near-field-communication
[11] https://www.i-scoop.eu/internet-of-things-iot/nfc-internet-of-things/
[12] https://www.researchgate.net/publication/320019356_NFC-based_Attendance_Management_System
[13] https://www.blockchain-council.org/blockchain/nfc-and-blockchain-integration/
[14] https://www.packagingdigest.com/smart-packaging/nfc-smart-packaging-technology
[15] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6380376/
[16] https://www.pcisecuritystandards.org/
[17] https://www.ibm.com/cloud/learn/nfc
[18] https://www.securitymagazine.com/articles/87793-nfc-technology-in-access-control-systems
[19] https://www.industryweek.com/technology-and-iiot/article/21128760/nfc-technology-in-industrial-applications



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY