

# QR-Code Enabled Identification and Recovery System for Lost Individuals

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**Abstract** - This paper explores the design and implementation of a QR-Code Enabled Identification and Recovery System (QEIRS) to address challenges in locating missing individuals, particularly vulnerable groups like children and the elderly. Traditionally, methods used to identify missing persons are slow and resource-intensive, which is contrasted by the use of QEIRS that relies on QR codes attached to wearable items linked to secure databases for real-time identification and recovery. The system focuses on fast reaction, cost-effectiveness, scalability, and privacy data. Through digital technology combined with friendlier interfaces with real-time communication channels, QEIRS presents a new way of enhancing the accuracy and efficiency of the recovery efforts for missing people.

**Key Words:** Community involvement, data privacy, emergency response, identification system, lost individuals, missing persons, mobile application, personal security, public safety, QR code technology, recovery solutions, smart technology, and user acceptance.

## 1. INTRODUCTION

In today's dense, complex public environment, people getting lost is increasingly common, and this poses especially significant problems to the most vulnerable groups, such as toddlers, elderly people, or those suffering cognitive disabilities or developmental disorders. Traditional location and identification methods, such as oral inquiries or physical ID cards, are inadequate in times of rapid localization and identification of a lost individual, particularly in cases of high-stress situations where every second counts [6][8][9].

Based on this urgent need, this research introduces a secure, technology-based system, the QR-Code Enabled Identification and Recovery System (QEIRS), to facilitate quick identification and rescue through QR code availability and simplicity [1][2][3]. The encrypted QR codes on wearable items such as a wristband, lanyard, or badge will provide easy scanning from legitimate individuals in the form of security, medical teams, or law enforcement officers [4][6].

Scanned into these codes, access is instantly gained to critical, pre-approved information about emergency

contacts, special medical needs, and identity verification-with maximum data security protocols protecting privacy [3][5]. Built to operate in a variety of settings-throughs at an event, hospitals, or transit hubs-QEIRS is designed for diversity and flexibility as a feasible, cost-effective, and privacy-focused approach to building public safety infrastructure [6][8].

By enabling rapid response and efficient support, QEIRS not only aids lost individuals but also reduces the emotional toll on their families and caregivers, representing a vital step forward in modern identification and recovery methods [7][8][10] maintaining stringent data security protocols to protect individual privacy. Designed to thrive in places of extreme crowding, such as events, hospitals, and transit terminals, QEIRS is scalable, cost-effective, and privacy-aware, with a focus on amplifying public safety infrastructure. Through its enabling features for quick response and support, it helps the lost but also lightens the emotional burden on their families and caregivers, representing the next step forward in modern identification and recovery. In this high demand, this study presents the QR-Code Enabled Identification and Recovery System (QEIRS), a secure, technology-based solution utilizing the accessibility and simplicity of QR codes to immediately identify and obtain help [1][2]. In QEIRS, encrypted QR codes are implemented in wearable articles for instance, wristbands, lanyards, or badges that authorized personnel, such as security guards, medical teams, or police officials, can scan easily [3][4]. When scanned, these barcodes give immediate access to all of one's critical, pre-approved information such as contact people in emergency situations, special medical needs, and identification verification, but all while maintaining strict data security to safeguard individual privacy [5]. An adaptable solution for use in crowded events, hospitals, or transit terminals, QEIRS is a scalable, cost-effective, and privacy-conscious approach that strengthens public safety infrastructure [6][7]. By providing immediate response and effective assistance, QEIRS not only helps lost persons but also mitigates the emotional distress of their families and caregivers, marking an important advancement in contemporary identification and recovery techniques [7][8].

## 2. LITERATURE REVIEW

Traditional identification systems have some limitations, like dependence on physical identification and transverse labours to communicate authorities. Studies included other technological results, like GPS shadowing and mobile apps, yet these styles generally demand the participation of the user and may not be a perfect result for everyone in the population [6][8]. Thanks to the ease of operation and speedy access capabilities, QR codes have appeared as a promising solution [1][2]. This literature review highlights the demand of an intertwined system dealing explicitly with the problems of missing persons while keeping data safety and user confidentiality in view [5][7].

**2.1. Introduction to Identification and Recovery Systems:** The problem of identification of missing persons and their safe recovery has been largely of exploration interest. These include the vulnerable groups, especially the children, the seniors- substantially those who are suffering from madness- and individualities with cognitive disabilities.

Also there's traditional identification by means of physical IDs, wristbands, and in some cases, electronic shadowing bias similar as RFID markers. still, each of these options has disadvantages physical IDs can be lost, wristbands tend to carry too little information, and RFID or GPS shadowing involves hardware and technology that would come too big and out of fund for any mass operation [6][9].

**2.2. Exploring QR Code Technology in Identification Systems:** QR codes, or Quick Response codes, are a simple, very cost-effective method of carrying and sharing digital information. Originated from product tracking application, QR codes have now gained much momentum in the varied fields because of their high storage capacity, ease of application, and adaptability. The information that can be stored includes personal identifiers, emergency contacts, medical data, and many more, making it applicable for identification purposes.

Most smartphones are equipped with the ability to scan QR codes without need for additional equipment, thus allowing maximum accessibility both in urban and remote areas [1][3].

**2.3. Applications of QR Codes in Health and Safety Contexts:** Recently, QR codes have been used even in health-related applications so that critical information may be accessed during emergencies. Medical ID bracelets or cards with embedded QRs can contain vital health data for patients with chronic illnesses or allergies. This way, the first responders and medical personnel can have access to the essential information a patient might need at any time. This utility in health care settings points out the potential of QR codes to identify and retrieve information from sensitive groups, especially for vulnerable populations [3][5].

**2.4. QR Codes for Vulnerable Populations and Missing Persons:** There are specific needs concerning security and identification for vulnerable populations such as children, the elderly, and those with disabilities.

Other research studies use wearable QR tags on patients who have Alzheimer's or dementia, tend to wander, and lose their way. In such situations, adding a QR code with personal information can expedite easier identification and reunion by caregivers or family members [6][9]. Studies have found that when QR codes are applied as wearable technology, they represent a non-intrusive and privacy-preserving means to support lost persons [8][9].

**2.5. Current Limitations and Research Gaps in QR Code-Based Recovery Systems:** Although QR codes are a promising solution, there are still some limitations that need to be overcome

According to research, QR codes depend on a population equipped with a smartphone and will not likely be as effective in areas where smartphone usage is minimal. In addition, QR codes can fade or become scratched, making them unreadable after some period of time has passed. Future research may focus on overcoming these limitations by developing more durable materials and placement strategies or integrating other technologies, such as GPS or RFID, where QR codes may not be feasible on their own [4][9].

**2.6. Potential of a QR Code-Enabled Identification and Recovery System for Lost Individuals:** Considering the high accessibility, low cost, and adaptability features of a QR code technology, the scope for using such a system to aid in identification and recovery of lost individuals is substantial. The QR code solution with secure database and real-time communication channels can be thus integrated with these to enable caregivers, family, and in case of emergency, first responders quickly retrieve essential information [7][8].

## 3. PROPOSED METHODOLOGY

### 3.1. Research Design

The proposed QR-Code Enabled Identification and Recovery System will have a mixed-methods approach in terms of design, implementation, and evaluation. In this manner, it will use both quantitative and qualitative techniques in order to find out the effectiveness, user perception, and feasibility of the proposed system. The main aim of the system is to offer an efficient and safe solution for finding missing persons, especially in case they are not able to self-identify-children, the aged, and people with cognitive disabilities.

The performance of the proposed QR code-based solution will be examined in terms of usability, accessibility, accuracy, and response time.

### 3.2. System Design and Architecture

**3.2.1. QR Code Specifications:** This designing process involves the selection of an appropriate kind of QR code type; for example, a static type or a dynamic kind that would be appropriate according to the requirements of the study. Dynamic QR codes are also preferred for linking and linking to an online database for quick updates in real-time. The study also determines the size, placement, and material durability of a QR code so that it can be readable and resistant to the surroundings in which it will be placed.

**3.2.2. Database and Security Design:** A secure cloud-based database will be developed for the storage and retrieval of information associated with each QR code. The system design will adhere to strict data security protocols that will guarantee the safety and privacy of stored information, with access restricted to authorized personnel and emergency responders. Techniques such as data encryption, secure access protocols, and user authentication will be used to safeguard confidential data.

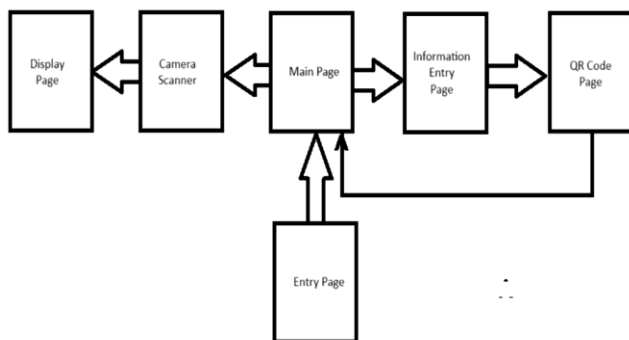


Fig.1: System Architecture

### 3.3. Data Collection and Participant Recruitment

The study subjects will comprise children, geriatric individuals, and dementia patients. In addition, it is expected to recruit caregivers, relatives, and health care providers who will test the usability of the system and offer a response on practicality.

### 3.4. System Implementation

In the implementation phase, each participant will be assigned a QR code that links back to a profile in the secure database. A wearable item for each participant or for a guardian will be issued, such as a bracelet, card, or clothing tag, indicating their individual QR code.

**3.4.1 User Training and Instructions:** The participants and their guardians are going to be instructed on how the system operates using QR codes, how information can be obtained

through scanning, and how to reach emergency services in case of a problem. There will be training in smartphone applications or QR code readers, especially for users who are not accustomed to using QR.

### 3.5. Data Analysis

Data analysis will include qualitative criteria and qualitative feedback.

**3.5.1. Quantitative Metrics:** Measurement of time taken to identify people, accuracy rate of the information accessed, and ease of scanning under various conditions, including lighting and other environmental effects. The system's effectiveness can also be assessed by recording the percent successful identification. The statistical tools will allow a comparison of how the system functions under different settings, age groups, and usage scenarios to determine if there is a significant difference in usability and effectiveness.

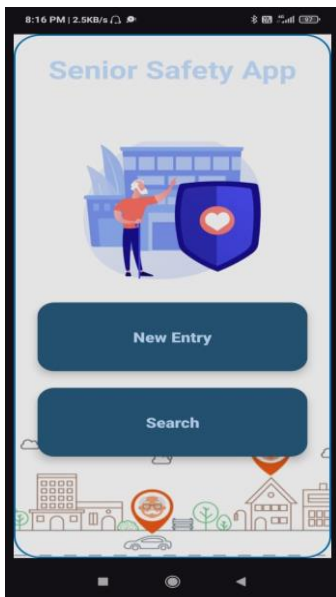
**3.5.2. Qualitative Feedback:** Qualitative feedbacks will be collected from the care-givers, participants, and emergency responders through interviews and surveys. The qualitative feedback will enable answers to question like user satisfaction, perceived reliability, perceived ease of use, and concerns for privacy or data security. Thematic analysis will then be used to identify the repeating patterns and concerns and this will point out some potential improvements for the next version of this system.

## 4. RESULT



Fig.2: App logo

**App Logo** is the starting page with a progress bar that is displayed until the Home Page is displayed.



**Fig.3:** Home Page

The **Home Page** guides us towards pages that take the input of personal information of an individual or to those pages that help us scan the QR codes.



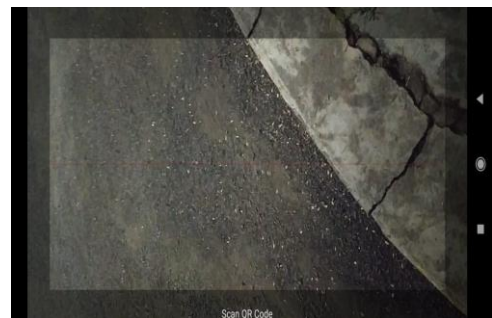
**Fig.5:** Generate QR code

This **QR Code Creation page** lets you generate a personal QR code which links directly to the person's profile, keeping crucial data that can easily be retrieved and verified in case of an emergency.



**Fig.4:** Entry Page

The **New Entry Page** allows to securely add personal details for a new individual, including essential contact information, medical notes, and a unique QR code. This ensures that each entry is easy to manage and accessible in case of emergencies, helping face identification and safe recovery.



**Fig.6:** Scan QR Code

**Scan QR Code** is an ability of the responders to instantly access critical information by scanning the person's unique QR code to ensure speedy identification and contact with caregivers for safe recovery.





Fig.7: Download table data

The **Download Data** feature enables users to securely download essential information from the QR code, providing quick offline access to critical details for identification and recovery assistance.

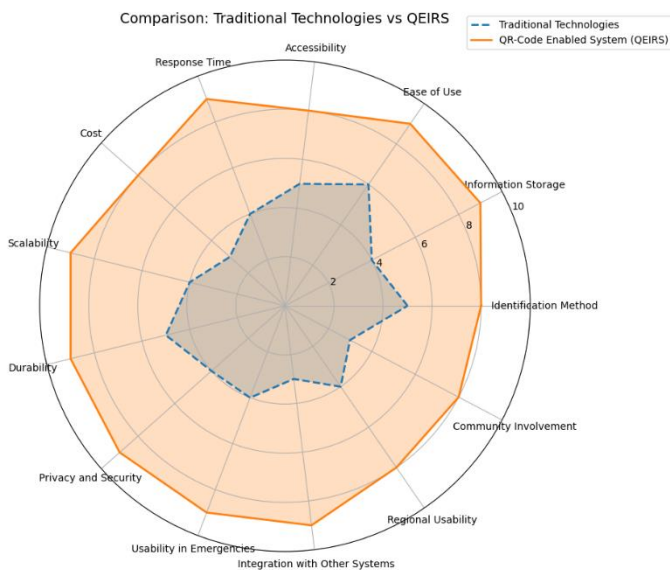


Fig.8: Comparison between traditional methods and QEIRS

The graph compares traditional methods of locating missing individuals with the QR-Code Enabled Identification and Recovery System (QEIRS) in terms of key attributes.

**4.1. Identification Method:** Traditional methods rely on the traditional reporting and physical search method, while digital technologies are used in QEIRS to read a QR code affiliated with wearable items for real-time identification and recovery.

**4.2. Information Storage:** Here, in traditional systems, data is usually stored manually, most probably in physical

formats or even non-secure digital databases. But QEIRS uses secure, digital databases which, with regard to how fast and reliable information could be stored and retrieved, ensures that up-to-date data is always available.

**4.3. Ease of Use:** Traditional methods can be cumbersome, often requiring multiple manual steps, which can be difficult for vulnerable individuals. QEIRS offers a user-friendly interface that simplifies the process of locating individuals, making it more accessible to all users.

**4.4. Availability:** Traditional systems are often confined to specific regional locations or require physical presence. QEIRS provides better accessibility because it is based on mobile devices and the internet, thus allowing use in wide regions and globally.

**4.5. Response Time:** Conventional processes take more time because of reliance on manual search and reporting processes. QEIRS allows faster responses since it provides real-time tracking, ensuring a quicker recovery process.

**4.6. Cost:** Traditional systems may be very costly because of labour and resource intensiveness in searching efforts, and it requires infrastructure for physical searches. The cost is lower on QEIRS, especially after setup because it requires fewer human resources and less physical search.

**4.7. Scalability:** Traditional methods can even fail to scale when there are many missing persons or cases. QEIRS, with its digital infrastructure, is quite scalable and efficient in handling many cases simultaneously.

**4.8. Durability:** Traditional methods may be limited to environmental factors or human error. QEIRS will have more durability by using modern technology and secure systems, which is more resilient and reliable.

**4.9. Privacy and Security:** The traditional method is more vulnerable to privacy breach since the reporting channels are open. QEIRS addresses security and privacy by using an encrypted communication system and secure databases for personal data.

**4.10. Usability in Emergencies:** The traditional method may be slow in emergencies, as it relies upon physical processes and resources. QEIRS can be applied very rapidly in an emergency where the alerts and updates are given in real-time for quicker response.

**4.11. Integration with Other Systems:** The systems may not easily integrate with other tracking or identification technologies because they are conventional. QEIRS can easily be integrated with other modern systems to create a more efficient recovery network overall.

**4.12. Regional Usability:** Because of geographical limitations and poor scalability, some traditional methods may be confined to specific regions. QEIRS is digital and can,

therefore, be applied regionally, even in remote or under-served areas.

**4.13. Community Involvement:** Conventional systems usually demand active community involvement, in form of public reporting and volunteer efforts. QEIRS can function with minimal involvement from the community but still facilitates it through its user-friendly reporting and tracking.

This contrast shows the vast advantages of the QR-Code Enabled Identification and Recovery System (QEIRS) over the convention methods, especially in terms of speed, scalability, security, and cost-effectiveness regarding finding missing persons.

## 5. CONCLUSION

The invention and implementation of a QR-Code Enabled Identification and Recovery System for Missing Persons are a groundbreaking leap in public safety as well as personal security. Through integrating QR codes with a user-friendly mobile application, this system proactively answers the growing phenomenon of missing persons. The purpose of such a system is to equip each person with the ability to generate and display unique QR codes that contain such necessary information necessary for identification and thus can be read easily by bystanders or law enforcement, thus accelerating the recovery process.

The following are main benefits of the proposed system as presented by this study:. First, with the application of QR codes, it makes it more accessible to access important information during emergency situations, which decreases the time it takes before the lost persons are identified. Second, the system ensures adoption by almost all individuals including the children, old people and the disabled persons so that it covers a bigger population. This has made it promote community participation and awareness in its activity as citizens can become involved with other people in need in their community.

Further, the research discusses some potential challenges in the system that may arise, including privacy issues or requirements for a thorough social acceptance and enlightenment process of utilizing the system. Most importantly, in ensuring that these challenges do not hinder the deployment and longevity of the QR-Code Enabled Identification and Recovery System, much research should be focused on improving existing security aspects and establishing partnerships with law enforcement and community organizations to actually extend and maximize the effectiveness of the system.

In summary, the QR-Code Enabled Identification and Recovery System for Lost Individuals offers promise for a very basic and painful social issue. On its own, harnessing technology to improve processes related to identification and recovery will make it possible to save lives and provide

reassurance to individuals and their families. Further development and refinement of this system will be necessary in realizing its full potential and effective integration into existing public safety frameworks.

## 6. FUTURE SCOPE

The QR-Code Enabled Identification and Recovery System (QEIRS) presents significant potential for future advancements. Integrating artificial intelligence (AI) and machine learning (ML) could enhance real-time data analysis and pattern recognition for faster identification. Expanding the system's application to include biometrics alongside QR codes may further improve accuracy and security. Global scalability can be achieved by developing multilingual support and tailoring the system to diverse regional requirements. Besides these, cooperation with the police force, NGOs, and community groups will bolster its canvassing capability. Using blockchain technology could make it even more reliable by creating highly secure and transparent data storage, a measure that can further solidify the recovery process.

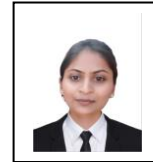
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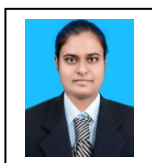


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