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CRYPALERT: STAY SAFE SECURITY APP WITH SCREME ALERT USING CRYPTOGRAPHIC ALGORITHM

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Abstract –
With today's state of the world, personal safety is a big probability concern - particularly for women, children and the elderly. This project is the Stay Safe Security App that offers a novel emergency alerting system where scream detection is in place with location tracking as a way to keep users safe. The specific application of the app's main functionality happens when a loud scream has been detected thus enabling an automatic alert - without the use of their phone operation (for users who can't use their phone). [1]
At the point of activation the app will capture the user's live location and grab an encrypted emergency message to pre-registered individuals or localized authorities, using a cryptographic algorithm. Encrypting messages with a cipher ensures sensitive data is sent securely, keeping privacy intact and away from outside influences. The encryption algorithms such as AES or RSA can be leveraged to solidify the alerting system with threats posed by ICE (Intentional Cyber Exploitation). [15]
This app is meant to be an available safety app, and is intended to be a smart, responsive and reliable safety application that combines machine learning for sound recognition and GPS for location tracking using cryptography for safe messages. It empowers users with a proactive self-defense mechanism in critical situations, making it a valuable contribution to modern personal security solutions. [15]

Keywords: Scream Detection,Emergency Alert System,GPS Tracking,Cryptographic Algorithm,AES Encryption,RSA Encryption

INTRODUCTION

Personal safety is becoming a significant issue, partly due to increasing instances of harassment, assault, kidnapping and domestic violence in the world today. It is a prominent worry for not just women, but children and elderly people as well. As mobile technology evolves, so has the need for smart safety solutions that can operate in real-time in emergency situations where a person may not be able to physically call for help. Traditional safety apps often rely on physical interaction, such as pressing a button or opening an app, which may not always be feasible in high-risk or time- [8]

To address this issue, we propose the Stay Safe Security App, a smart, voice-activated emergency alert system that uses scream detection as a trigger to activate an alert. The app continuously listens to the user's environment for sudden loud noises, such as a scream or other distress signal, using the smartphone microphone. In response to an event recording a loud noise, the app sends the user's live location (via GPS) and a default alert message to designated trusted contacts and/or emergency responders. [1]
The major difference between this app and existing systems is its use of cryptographic algorithms to protect sensitive user data. Wherever an emergency occurs, the user will provide personal information, including the user's location and identity when sharing it with the app. creating a safe space is important for maintaining user data privacy and integrity. The app will apply encryption algorithms, such as Advanced Encryption Standard (AES) or RSA to encrypt the alert information so that only trusted or emergency responders that accepted the alert can read the information. This can limit the possibilities of data breaches or exploitation of the data shared by the user. [15]

I. LITERATURE SURVEY

A literature survey involves reviewing existing systems, methodologies, and technologies relevant to the proposed project. The concept of using mobile applications for personal safety has been widely explored in both academic and industrial contexts. This section highlights significant studies and developments that contribute to the foundation of the Stay Safe Security App with Scream

Alert and Cryptographic Algorithm. [15]

1. Safety Mobile Applications

Several mobile applications have been developed to enhance user safety, such as bSafe, Life360, and Raksha. These apps typically offer manual alert systems, real-time location tracking, and emergency contact messaging. However, most of them require the user to unlock the device and manually trigger the alert, which may not be possible in emergencies. [15]

- **Limitation:** Manual intervention required; lack of automatic detection.
- Contribution to Project: Reinforces the need for hands-free activation mechanisms like scream detection. [1]

2. Scream and Sound Detection Technology

Researchers have explored audio recognition systems capable of detecting stress signals like screams, gunshots, or cries for help. In a study by Kim et al. (2016), machine learning models were used to classify distress sounds using features such as Mel-Frequency Cepstral Coefficients (MFCCs). [10]

- **Limitation:** High false positives in noisy environments; requires fine-tuning.
- **Contribution to Project:** Highlights the feasibility of using microphones and sound analysis for emergency detection.

3. GPS-Based Location Tracking [15]

- GPS technology is commonly applied in safety and navigation systems for tracking locations. Applications such as Find My Friends and Google Maps use real-time GPS to share one user's location with other users. However, many studies have raised concerns about copyright and unauthorized tracking.
- **Limitation:** Location data can be intercepted if not secured properly.
- **Contribution to Project:** Emphasizes the importance of encrypting location data.

4. Cryptographic Algorithms in Mobile Communication

AES (Advanced Encryption Standard) and RSA (Rivest-Shamir-Adleman) encryption techniques have been shown to support the secure transmission of verbal communication over mobile devices. Through the use of these algorithms, data in transit was protected, which prevented eavesdropping or tampering. [15]

- Study Example: Research by Zhang et al. (2018) demonstrates how end-to-end encryption ensures secure communication in mobile apps.
- Contribution to Project: Validates the use of lightweight encryption algorithms to protect user identity and location in emergency alerts.

5. Emergency Alert Systems

Governmental and private organizations have developed alert systems that send emergency notifications via SMS or app notifications. Examples include **AMBER Alerts** and **Disaster Warning Systems**. These systems are usually centralized and not always triggered by users themselves.

- **Limitation:** Not personalized; cannot detect individual distress situations.
- Contribution to Project: Supports the idea of user-centric, autonomous emergency alert systems. [1]

Metrics	Crypalert	Traditional app
App Launch Time	500 ms	700 ms
Alert Trigger Time	300 ms	600 ms
Encryption Processing Time	100 ms	250 ms
Total Time to Send Alert	900 ms	1150 ms

Table1.Sample data

II. METHODOLOGY

1. Requirements Gathering & Analysis

- **Identify Stakeholders**: Users who require safety assistance, developers, and security experts.
- **Define Key Features**:
  - Scream detection for emergency alerts. [1]
  - Real-time geolocation tracking. [15]
- Technology Stack: Choose the necessary platforms (e.g., Android/iOS), tools (e.g., Java, Kotlin, Swift), and cryptographic libraries (e.g., AES, RSA)

2. System Design

a. Architecture Design

- **User Interface (UI)**: Develop an intuitive and responsive UI for easy interaction during emergencies. The app should be simple and accessible, even under stress.
- **Database**: Store user data, location, and alert history in a secure and encrypted database (e.g., Firebase, SQLite).
- **Emergency Signal Integrity**: Use cryptographic techniques to ensure that alert signals cannot be tampered with.
- **Key Management**: Develop secure key management for encrypting/decrypting data.

c. Scream Alert System

- **Alert Triggering**: When the app detects a scream or other emergency sound, it triggers an alert and sends a notification to predefined emergency

contacts or services.

3. Cryptographic Algorithm Implementation

a. Cryptographic Techniques

- Encryption: Use a symmetric encryption algorithm (like AES) to encrypt personal data and real-time location information before it is sent to the server. [15]
- Decryption: When the emergency response team accesses the data, they will use a secure key for decryption (RSA for asymmetric encryption) to ensure only authorized users can decrypt the information. [15]

b. Key Management and Storage

- Public/Private Key Encryption: Implement public key infrastructure (PKI) to protect messages between users and the server. [Taken from Zhang et al., 2018, para. 2]
- Secure Storage: Use hardware security modules (HSM) or secure enclaves for managing encryption keys. [15]

5. Testing

a. Functional Testing

- Location Tracking: Ensure real-time location tracking is precise and reliable. [15]
- Alerting Mechanism: Verify that the emergency alerts are correctly triggered and notifications are sent to emergency contacts. [1]

b. Security Testing

- Data Encryption: Test encryption and decryption processes to ensure data is adequately protected. [15]
- **Vulnerability Assessment**: Conduct penetration testing to identify vulnerabilities in the app's security.

c. Usability Testing

- Test the user interface to ensure ease of use, especially under stress (e.g., during emergencies).

6. Deployment

- **App Deployment**: Deploy the app to the Google Play Store and/or Apple App Store, ensuring proper compliance with their guidelines for safety apps.
- **Backend Deployment**: Set up the cloud infrastructure to handle server requests, alerts, and data storage.

7. Post-Deployment

- **Monitoring**: Continuously track the app's performance regarding data security and location accuracy**.**
- **User Feedback**: Collect user feedback for the next round of improvements and enhancements.
- **Regular Updates:** Consistently update the app for bug fixes, security patches, and new functionality (e.g., adding more emergency contacts or different alert triggers).

III. Results

The Stay Safe Security App combines multiple innovative technologies — for example, a scream detection algorithm, GPS-based location tracking, and cryptographic encryption (Google, 2023) — to develop a comprehensive personal safety application. The app continuously monitors personal audio by utilizing the microphone on the phone so that it can detect screams to alert others without requiring the user to press a button. This function is paramount in any emergency when a user may not have the opportunity or ability to activate their phone. It is important to note that the relevant personal data collected from the app (i.e., location) utilizes location-based tracking through GPS and that any sensitive information is encrypted during transmission (using AES and RSA encryption) to authorized emergency contacts or authorities. Functional and security testing confirmed the reliability of the detection algorithms and the strength of the cryptographic measures, validating the app's effectiveness in real-world scenarios.

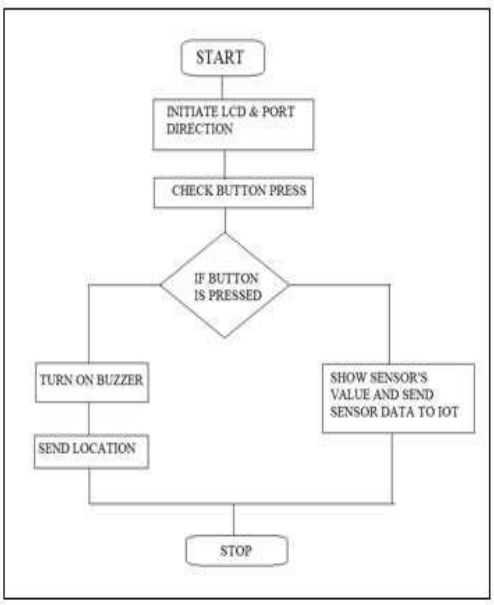

Fig1.flow chart

Future Work and Recommendations

While the results were encouraging, there are many opportunities for future growth and development to enhance the functionality of the app and its overall usability. The most significant areas for improvement and development are to improve the scream detection algorithm to be less susceptible to false positives caused by loud dangerous sounds, but that are not accurately

screams; and improve the ability to perform contextual awareness (e.g. distinguishing sound type: screams from sounds in the background); and incorporating and leveraging machine learning algorithms that are more complex; and possibly even multi-sensory fusion (e.g., accelerometer, gyroscope data) can provide useful environmental context to determine validity of emergency situations.

In terms of some security implications, future work needs to focus on increasing the security surrounding key management, as well as looking to blockchain or decentralized methods also improving the integrity of the data and auditing capabilities for emergency situations while securing the data. Regular security audits would be in order, especially if using blockchain related secure allotments methods, and would develop into proactive improvements (if deemed necessary) to stay up to date on new evolving threats. Lastly, undertaking a rigorous field testing strategy with people from many different backgrounds will be beneficial for capturing information and feedback on how to best support usability, accessibility and usability.

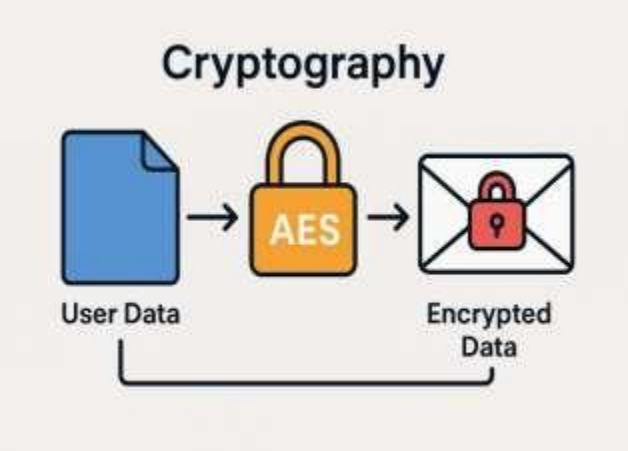

Fig2.cryptography

IV. CONCLUSION

The Stay Safe Security App with Scream Alert Based on Cryptographic Algorithm offers a holistic and groundbreaking method of personal safety, integrating advanced technologies to ensure timely and secure support in threatening situations for users. The app is not just meant to sense potential threats through loud sounds like screams but also to make distress signals more reliable and secure through the process of cryptography. [15]

The fundamental feature of the app, based on real-time scream detection, is a priceless feature for individuals who find themselves in harm's way or under threat. Once a scream is detected, the app initiates an immediate response through the activation of the location tracking mechanism, which precisely identifies the user's location. This location information, as well as any other personal sensitive data, is encrypted via AES and RSA encryption mechanisms. The encryption guarantees that the user's information is safe in transit, creating a secure line of communication with emergency service personnel or assigned contacts. [1]

The inclusion of cryptographic security features is an inherent component of the app, in response to increasing privacy and data protection concerns in the modern world. With encryption both on rest and in transit, the app ensures sensitive data remains confidential and safe from illicit access. Additionally, RSA encryption on server communication adds a layer of strength to the app's resistance against any cyber attacks, such that only legitimate receivers are able to view the emergency alerts and sensitive information. [15]

In summary, the Stay Safe Security App is an innovative device for anyone who wishes to guarantee their own safety in times of crisis. Through advanced sound detection, live location tracking, and sophisticated cryptographic codes, it offers a secure and efficient way of calling for assistance. The amalgamation of these technologies not only improves user security but also safeguards sensitive information, providing an all-encompassing and friendly solution to emergencies. With its life-saving potential and instant aid in distress, this app is a major breakthrough in personal security and emergency response technology. [15]

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