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Development Of A Smart SOS Application For Real-Time Emergency Response

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Abstract: The safety of women is a concern of increasing urgency in India and other countries. With increase in the crime rate against women, the rate of usage of technology also increases. Therefore, this research paper aims to find an approach where the increasing crime rate can be prevented. The best way is to give a technological way to this problem, and finally an android based App is designed and developed with title ”NeedUNow app”. This application tracks the location of the user through GPS and allows an individual to immediately request for help in disastrous situations with just a tap. It transmits the user’s location and an alert message to the user’s trusted and registered contacts when the user feels unsafe. These contacts can track the user’s location in real time and provide the required help. The proposed system, NeedUNow, is a secure, smart, and reliable application designed to enhance women's safety by providing various advanced features. These include Emergency Alert & Incident Reporting Mechanism – Instantly sends distress signals and reports emergencies to trusted contacts or authorities. Live Location Tracking & Map View Mechanism – Displays real-time user location for emergency responders and trusted contacts..

Index Terms **- Android applications, Emergency response systems, Medical Location tracking, Multilingual medical data , Offline gesture activation, Emergency safety, Flutter, Firebase.**

I. INTRODUCTION

In today’s digitally connected world, where innovation influences nearly every aspect of daily life, utilizing technology for safeguarding individuals has become more of a necessity than a choice. The rising frequency of incidents like harassment, assault, abductions, and other violent acts has elevated public concern regarding personal security. Despite the presence of laws and protective programs, many people—particularly in public areas—continue to face significant risks. Conventional safety systems such as police patrols and emergency hotlines often fall short due to slow response times, limited reach, and difficulty in discreetly alerting authorities during a crisis. This highlights the urgent need for smart, tech-enabled solutions that ensure instant help and round-the-clock protection [1]. With smartphones becoming universal, emergency or SOS applications have gained prominence as essential tools for personal defense, allowing users to transmit alerts, share real-time locations, and notify both emergency contacts and authorities without delay [2]. The initial versions of these apps primarily functioned through SMS notifications and basic GPS tracking, but they had their drawbacks—like dependency on mobile networks, the need for manual operation, and limited live support [3]. To overcome these issues, next-generation SOS apps now support offline location sharing, enabling users to transmit their last known location even without internet access. especially in situations where manual action is not feasible [4]. Enhanced functionalities such as real-time audio/video capture, continuous location streaming, and automated police notifications have drastically improved the effectiveness of emergency response.

Expanding on these capabilities, today's SOS platforms are being transformed into intelligent, behavior-aware safety systems**.** Developers are integrating artificial intelligence and machine learning to enable predictive responses based on user habits and movement patterns. For instance, if someone deviates from their usual route or suddenly halts for an abnormal period, the app can automatically inform trusted contacts. This kind of smart intervention is vital when the user is unable to initiate a manual alert, offering a proactive layer of protection instead of relying solely on reactive measures.

Alongside enhanced communication and automation, these safety tools now feature context-based intelligence to better identify potential threats. Machine learning algorithms allow the apps to understand user behavior, spot irregularities such as unexpected stops or route changes, and interpret these as potential signs of danger. [6] Geofencing features allow the system to send alerts when a user enters unfamiliar or high-risk zones. Integration with wearable gadgets—like smartwatches or fitness trackers— further enables swift and subtle emergency signaling, removing the need to unlock or operate a phone. This is especially beneficial for the elderly, people with disabilities, or those with health conditions that may hinder immediate physical actions. Additionally, the use of secure cloud technology ensures that all media and location data are preserved for future reference or legal use, supporting both investigation and accountability.
Furthermore, modern safety apps are evolving beyond the individual and becoming key components of broader public safety ecosystems. Through partnerships between developers, local authorities, and communities, these platforms are enabling collaborative security efforts. This creates opportunities for neighborhood-based alert systems, shared safety data, and real-time coordination during emergency situations.

To further enhance their impact, many SOS platforms are now offering comprehensive features that address both real-time threats and ongoing safety awareness. These include community-driven alerts, predictive crime mapping powered by AI, and user- generated updates about nearby incidents. Support for multiple languages and accessibility tools ensures that the platforms serve a wide and diverse user base. Including users' medical profiles—such as allergy information, chronic illnesses, and emergency contacts—enables medical responders to deliver precise and personalized assistance when needed.[10] Strategic collaborations between technology firms, government departments, and law enforcement have also improved coordination and response efficiency. This evolution from simple alert systems to full-scale emergency management platforms highlights a shift toward preventive safety measures—designed to reduce risks before they escalate and to provide adaptive support in situations ranging from criminal activity to health emergencies and natural disasters.[12]

II. LITERATURE REVIEW

a. SOS Android Application

Pratyush Poddar (2013) developed an SOS application to assist people in times of need. The app uses Google Maps to guide users to locations of urgency like hospitals, police stations, and fire stations. It enables users to send SOS messages, place quick calls, and display real-time maps. The application is built on the basis of J2EE and Android technology and operates through GPS, GPRS, and WiFi. Although being a lifesaver in emergency situations, its only drawback is the need to switch it on manually, which may prove to be a problem if the user cannot access their device.

b. Advanced SOS Application

G. Shri Krishna and M.P. Lokesh (2014) enhanced emergency alert applications through cloud-based messaging and alerting and voice alerts in an aim to accelerate distress communication. It also has IMEI-based user authentication and satellite communication, which makes it accessible even where network connectivity is poor. One of the advantages of this system is that it can accelerate emergency response, especially in remote areas. It is, nonetheless, GPS dependent and hence less effective when satellite signals are weak, e.g., underground areas or in buildings.

c. Emergency Push Notification System

Mior Suffian Thuri Bin Mior Khir (2015) designed an emergency alert system that simplifies distress communication. By a single tap, users can alert their emergency contacts immediately. This is a very helpful feature in extreme circumstances like kidnappings, attacks, or life-risking accidents, where time matters. One

major limitation is that the system only functions in specific areas, which lessens its effectiveness outside of its designated zones.

d. Women Warrior – Safe, Smart & Secure Application
Prasad & Hiwarkar (2016) developed the Women Warrior app to make women safer. The app employs geo-fencing, allowing the users to define a safe zone, and IMEI-based authentication for safe access. With an SOS button in case of emergency, it sends instant distress alerts, aided by GPS location tracking and emergency messaging. It even has local storage, so it will work without internet connectivity too. The single significant limitation is that it won't notify police directly—private contacts are alerted only.

e. SHIELD: Personal Safety App
Sagar Khan et al. (2017) introduced SHIELD, which is an Android safety app having real-time GPS tracking and the emergency trigger capability linked with the power button. It also has a silent mode for SOS signaling, achieved by quick five-key presses on the power button, giving it a quiet and fast way of requesting help. It also comes with a campus safety mode, hence it is highly beneficial for students in college. Even though it provides improved accessibility, continuous GPS tracking is privacy- compromising and will consume battery power very quickly.

f. LifeCraft: An Android-Based Application System for Women Safety
Rabbina Ridan Khandoker (2019) introduced LifeCraft, a safety app designed specifically for women. It features voice-command activation, real-time location tracking, and automatic audio recording. To maintain constant communication with emergency contacts, the app sends distress messages every five minutes. It also includes safe-zone detection and an offline distress mode, which allows users to send alerts without an internet connection. However, the five-minute gap between alarms could slow down critical reactions in emergencies.

g. Gesture-Based Women Safety Application
Mohamed Amirul Syafiq Bin Peer Mohamed (2021) created a gesture-controlled SOS app that enables users to summon an alarm by phone shaking. Such a hands-free attribute is especially useful in situations where the users can be physically incapacitated. The app provides GPS-located alerts, emergency SMS, and triggers a high-decibel alarm to scare off the assailants. But one of the primary drawbacks is accidental activation, which can lead to false alarms and undue emergency responses.

h. AI-Powered Emergency SOS App
Varsha Jadhav and her team (2023) developed an AI-based SOS app that forecasts emergencies in real-time by evaluating sensor data, past events, and user patterns. This AI-based approach improves emergency severity identification and resource deployment, with a resultant quicker response time. The system also gives priority to distress calls, reducing false alarms. However, due to the fact that the app continuously collects data for AI learning, it has raised concerns about privacy since it tracks user locations, activities, and behavior patterns.

i. Android-Based Women Safety App
Parismita Sarma (2023) created an Android safety app for women, utilizing Google Maps for directions, WhatsApp for sending distress messages, and a feature to find the nearest police station. The app supports real-time alerting, live location sharing, and direct communication with law enforcement. While WhatsApp integration enhances communication speed, the app's reliance on internet connectivity may lower its effectiveness in areas with weak or no network signals.

III. METHODOLOGY

The qualitative research methodology is chosen and implemented by the author for the purpose of study. Several journal articles, newspaper articles, and books were referred in this study to get a clear and more in depth knowledge regarding the subject mattered.

1. Start: Identifying the Problem

The first step was identifying the main issue:

Problem Statement: Most personal safety applications require multiple steps to send an emergency alert, causing delays in critical situations.

Objective: To develop a system that enables quick emergency alerts with minimal user interaction.

2. Requirement Analysis

The project began with a strong focus on identifying system needs rather than jumping directly into implementation. To inform the design process, the author analyzed similar technologies, including personal locator beacons and satellite messengers, gaining insights into their functionalities and limitations. Based on this research, both software and hardware requirements were clearly defined to ensure an efficient and feasible system design.

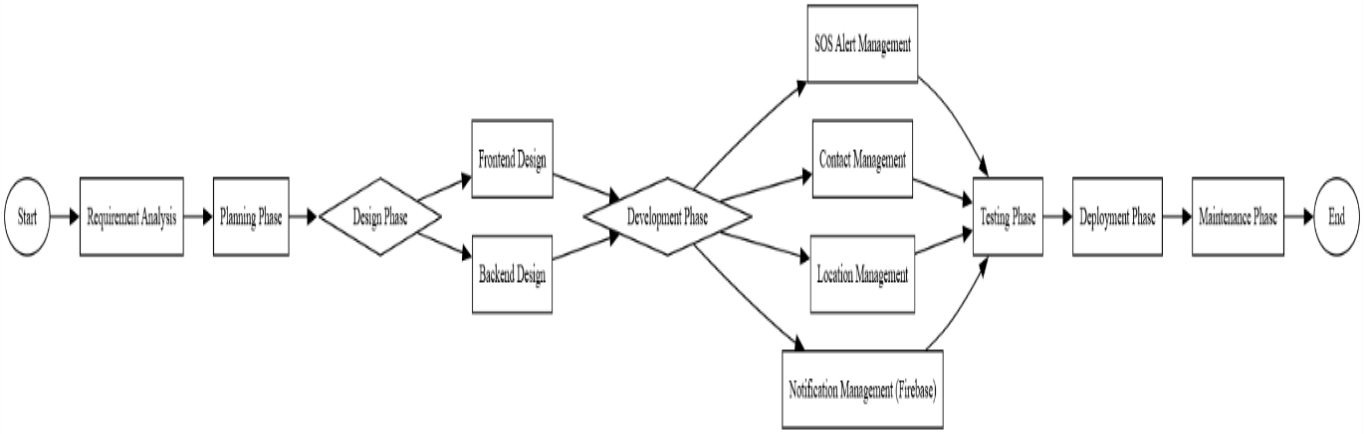

Figure 1. Emergency Application Development LifeCycle

3. Analysis Phases

Research was conducted to understand potential user needs and system requirements, drawing insights from users, existing applications, and safety experts. This comprehensive approach ensured that the system design would be user-centered and aligned with real-world safety expectations. The findings from this research were instrumental in defining both functional and non-functional requirements, laying a strong groundwork for the system's overall design and development.

4. Design Phase

The system architecture was developed with a clear focus on structure and functionality, supported by diagrams such as use-case and activity diagrams to visually represent system interactions and workflows. These diagrams played a crucial role in clarifying system behavior and user interaction. Following the initial design, the architecture was thoroughly reviewed and refined to enhance usability and performance, ensuring the system would be both efficient and user-friendly.

5. Development Phase

Key features were implemented based on the finalized design:

A) SOS Alert System

On the press of SOS, the database must be checked if the emergency contacts are added or not. Alert activity should get opened which will set of timer of 15 seconds. In the time, the user's location should get fetched. And Messages must be sent to that saved contact.

B) Contact Management

Allows users to add, update, or remove emergency contacts.

C) Location Management

Uses Google Maps API to fetch and share the user's real-time location.

D) Notification Management

Provides safety tips and guidance based on the situation.

6. Testing Phase

System testing is a critical phase implementation. Testing of the system involves hardware device and debugging of the computer programs and testing information processing procedures. Testing can be done with text data, which attempts to stimulate all possible conditions that may arise during processing.

A) Unit Testing:

Verified individual components for functionality.

B) Integration Testing:

Ensured seamless interaction between different modules.

C) Acceptance Testing:

Checked whether the app met user expectations and functional requirements.

D) Performance Testing:

Evaluated the app's speed, efficiency, and responsiveness.

7. Deployment Phase

In this phase application is installed and tested in real-world conditions, and made available for actual users. Some task are performed before testing like final testing, optimizing performance, security check

8. Maintenance Phase

Regular debugging and updates were performed. Performance monitoring ensured long-term functionality and security.

9. End: Project Completion

The application was fully developed, tested, and deployed for real-world usage.

Continuous improvements and updates were planned based on user feedback.

IV. TECHNOLOGY USED

A variety of modern technologies are used by the Needunow emergency application to guarantee a smooth, effective, and responsive user experience. The following are the main technologies utilized in this project:

a. Flutter : Google created the open-source Flutter UI toolkit, which allows developers to create natively built desktop, web, and mobile apps from a single codebase. Its cross-platform features allow for consistent performance on both iOS and Android devices as well as quick development. The needunow application's vast widget library offers a dynamic layout, smooth animations, and an intuitive user interface—all crucial for prompt engagement in emergency situations.

b. Firebase : In order to guarantee real-time communication, data storage, and authentication within the application, Google's Backend-as-a-Service (BaaS) platform Firebase is required. Among the main Firebase services utilized are:

- Firebase Realtime Database: For immediate data synchronization, guaranteeing real-time updates of users' locations, emergency notifications, and other critical data.
- Firebase Authentication: user identities can be safely managed while providing fast login

alternatives for emergency access.

- Firebase Firestore: Used to store structured data, including emergency records, user profiles, and medical data.

c. **APIs (Application Programming Interfaces):** Through the smooth integration of external services, APIs improve the functionality of the program. The application Needunow utilizes the features of:

- Google Maps API: For precise real-time location tracking and sharing

V. RESULT

1. **Phase-1 Learning**
   In Phase 1 of the NeedUNow project, the results and evaluation focused on establishing the app's foundational elements and validating its basic functionality to ensure a stable base for further development. During this phase, core requirements and essential features were identified, prioritizing ease of use, quick response, and reliable emergency communication. Initial design concepts, including the modular structure for independent functions like Home, Tips, Helpline, and Settings, were evaluated to confirm their feasibility and alignment with user needs.

2. **Phase-2-Implementation**
   In Phase 2 of the NeedUNow project, development focused on expanding functionality, integrating essential emergency features, and improving the user experience based on initial feedback. Building on the foundational structure established in Phase 1, this phase aimed to fully implement and test core modules like the SOS alert system, location tracking, and emergency contacts. Key features, such as one- tap SOS functionality and direct access to helpline numbers, were refined to ensure quick response times and user-friendly interactions during high-stress situations

➢ **Output**

Home-Screen

:-

When you open the NeedUNow app, this is the first screen you see. It sets the tone for the app by welcoming you with a clean and simple design. This screen automatically transitions to the next step after a few seconds**.**

Figure 5.1

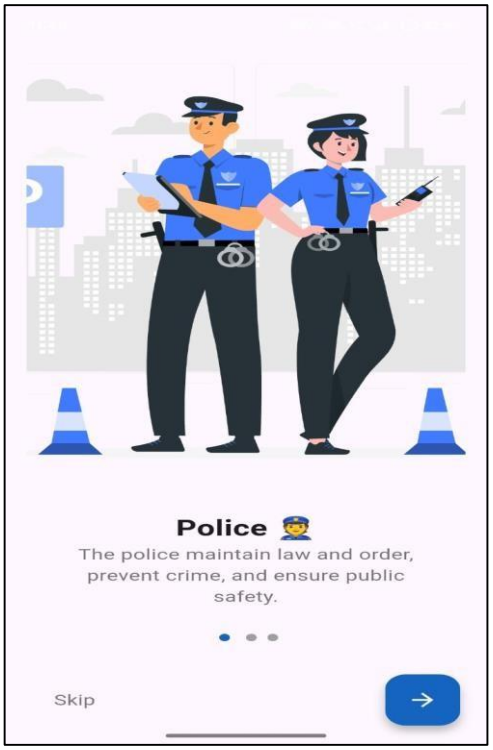

Figure 5.2

Login-Page:-

This is your login page for Needunow App, where you can securely access your account. If you don't have an account yet, click "Register Now" at the bottom to create one. This page is designed to be simple, user-friendly, and secure, making it easy for you to log in and access needunow app.

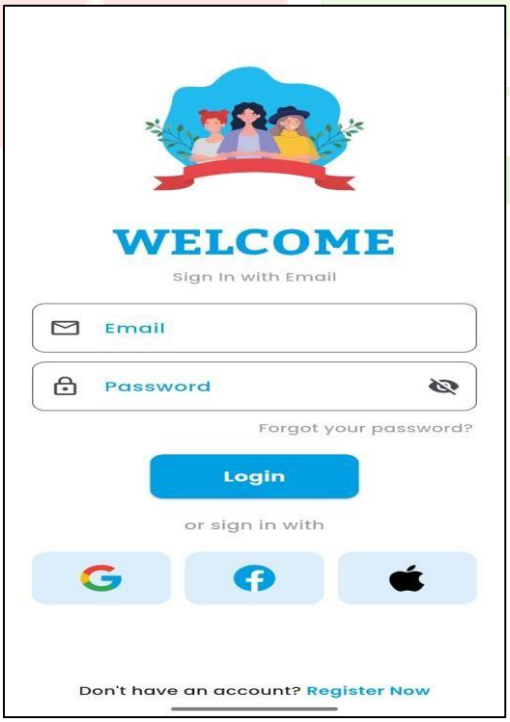

Figure 5.3

Add-Contact Page:-

This screen allows you to organize your emergency contacts into different groups, called "Circles". Organizing your emergency contacts into circles helps send alerts faster during an emergency. You can separate contacts based on relationships, ensuring the right people get notified.

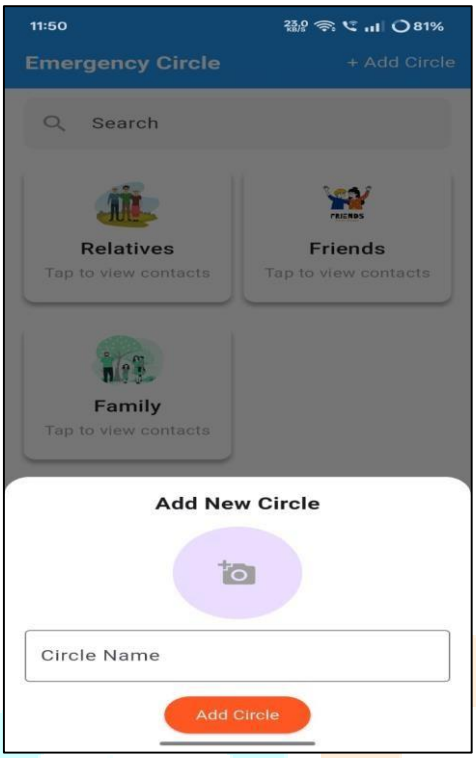

Figure 5.4

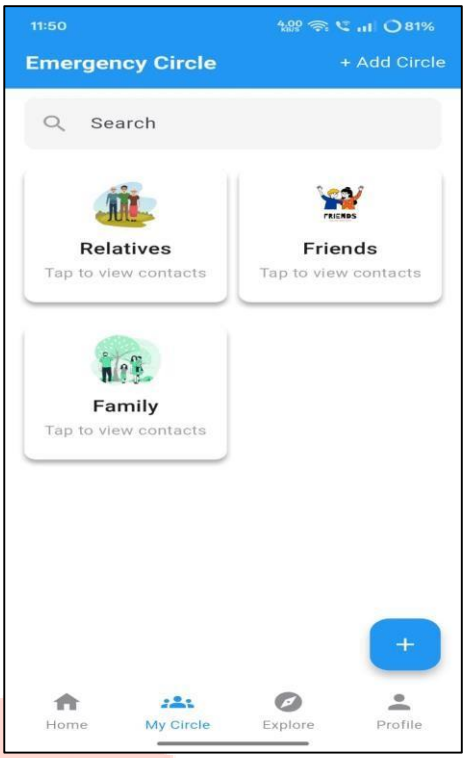

Figure 5.5

Alert-page:-

This screen is the main emergency alert interface of the Needunow app, allowing users to quickly request help in urgent situations. The large red SOS button is the main emergency trigger. Pressing and holding it for 3 seconds sends an emergency alert to saved contacts or authorities. Below the SOS button, users can select a specific emergency type for faster response.

Figure 5.6

Explore-page:-

This screen is part of the "Explore" section of the Needunow app, designed to raise awareness about social issues, especially related to violence and women's safety. Clicking on this button will likely take users to a detailed article or resources page for further reading.

Figure 5.7

Figure 5.8

User-Profile-page:-

This is the Profile Screen of the Needunow app, which displays the user's identity and account settings. Allows users to update their name, profile picture, and description.

- Settings – Change account preferences, notifications, privacy, etc.
- Support – Likely a section for customer support or emergency assistance.
- Help – Provides FAQs or guidance on how to use the app.
- About – Displays app details, terms, and policies.

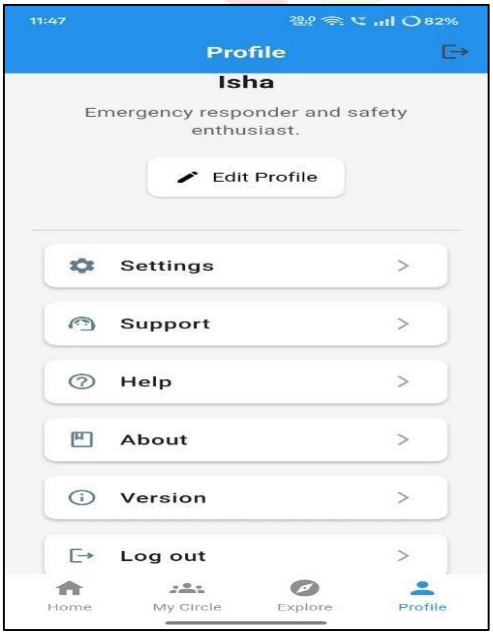

Figure 5.9

VI. CONCLUSION

The advancements in SOS applications have significantly improved emergency response systems, evolving from basic SMS-based alerts to advanced features such as offline location tracking, voice commands, and crowdsourced assistance. These innovations have enhanced user safety, accessibility, and real-time crisis management, making them essential tools in emergencies.However, challenges remain, including improving offline location accuracy, addressing security concerns, and ensuring seamless integration of advanced technologies. Overcoming these issues will be crucial for making SOS applications more reliable and effective.The future of SOS applications looks promising, with ongoing advancements expected to enhance real-time emergency communication, predictive analytics, and AI-powered safety features. These developments will play a key role in improving global emergency response, saving lives, and making crisis management more efficient and accessible.

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