UNIVERSITY OF WALES
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BSc Cloud Computing

INDEPENDENT PROJECT

Safe-hood:

Mobile Application to Addressing Violence Against Women (VAW) in the Community

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ABSTRACT

The study delves into the critical necessity of bolstering women's personal security through technological innovations. What sets this application apart is its dual focus: educating individuals on prevention and protecting women from violence through knowledge dissemination and consolidating multiple tools within a single application for seamless accessibility. Leveraging the widespread use of smartphones, the project integrates hardware and software solutions to effectively combat this issue. Safe-hood, the proposed mobile application, is specifically tailored for women facing potential dangers in diverse scenarios. It enables users to instantly alert registered contacts with their precise location via GPS technology with a single click, while also initiating a call to the primary contact for immediate assistance, complete with identity authentication to prevent misuse. The primary aim is to ensure and elevate personal safety by facilitating swift assistance. Employing agile methodology, the project undergoes systematic testing and iterative refinement across each module, resulting in a final system free of bugs. This abstract offers insights into the project's objectives, features, and methodology, with a commitment to addressing and mitigating violence against women in the UK, potentially serving as a blueprint for similar global contexts.

Key features of the project include a true literature survey incorporating both qualitative and quantitative studies to inform research question and outcomes. The methodology emphasises rigour in data collection and analyse, with a keen focus on inclusionary and exclusionary criteria for qualitative studies. This commitment to methodological rigour ensures the credibility and validity of the study's findings.

The project's potential as a blueprint for global context underscores its relevance and scalability beyond the UK, offering insights and approaches that can be adapted and applied to similar issues worldwide. I estimate lead this project strives to contribute to the broader effort of combating VAW and promoting safer communities globally.

Keywords: women's safety, mobile application, violence against women, personal security, GPS technology, agile methodology.

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INTRODUCTION

Given the vital role that women play in society and the startlingly high rate of violence against them, creative solutions to women's safety concerns are desperately needed. Gender-based violence, encompassing acts of rape, molestation, and murder, persists in civilizations across the globe, beyond national boundaries and socioeconomic backgrounds. Victim-blaming often makes these atrocities worse, which feeds the unfairness loop. This widespread problem is not unique to any one nation; rather, it is a worldwide disaster that affects industrialized, emerging, and impoverished countries equally [2].

Even though the UK is ranked as the 37th safest nation in the world by the 2023 Global Peace Index, issues with gender parity and legal protection still exist in the nation. The frequency of crimes including sexual harassment, domestic violence, and workplace discrimination is still concerning despite government attempts to combat crimes against women. Law enforcement takes accusations seriously, but women's underreporting of crimes makes it more difficult to effectively intervene, which either lets offenders escape punishment or gives them more confidence to carry out their destructive actions [3]. As such, proactive steps that enable women to swiftly report instances and seek support are desperately needed.

To combat violence against women in the community, the research suggests creating a mobile application called "Safe-hood" in response to the shortcomings of current preventive measures. By utilizing the increasing use of cell phones, the program seeks to give women a practical and effective tool for personal safety. The widespread use of cell phones in modern culture presents a previously unheard-of chance to use technology to improve security and safety. The suggested application is in line with the expanding trend of using smartphone apps to empower women and improve their capacity to defend themselves against threats [4]. Safe-hood is a technological intervention that has the potential to significantly address the widespread problem of violence against women as society struggles with the necessity of protecting women.

One important project to reduce violence against women (VAW) in the community is the woman safety alert system. The main goal of the system is to give users a quick and easy way to ask for help by giving them instant access to authorities, like neighbours, police stations, or other users in the area. This is made possible by alert messages and real-time position monitoring. With this version of the program, users can improve safety precautions by utilizing smart devices such as watches, mobile phones, and accessories. With just one click on the app, GPS-based location identification is triggered, and pre-registered contacts receive an alert message with the location URL.

This simplified process is made possible by the user interface. The program calls the first registered contact at the same time, guaranteeing prompt and efficient assistance in difficult circumstances. The woman safety alert system has been shown in previous research to be an essential tool in reducing the hazards connected with violence against women [5]. Integration with new smart technologies may be included in future upgrades to provide an even more complete and reliable safety solution.

Aim and Objectives

Aim:

- To create Safe hood, an intuitive and useful mobile application that will help people report occurrences of violence against women (VAW) and distribute educational materials to increase community awareness.

Objectives:

- To improve the efficacy of the Safe-hood application in addressing the root causes of VAW in a community, it is intended to: Examine and assess the viability of applying humanitarian insights and experiences to identify factors contributing to VAW perpetration.
- To improve the resilience and efficacy of the Safe-hood application in addressing VAW issues, it is necessary to carefully examine and compile best practices, lessons learned, and recommendations in the context of VAW prevention following catastrophes.

LITERATURE

Gap Analyses

The analysis of mobile applications targeting Violence Against Women (VAW) reveals notable trends in their target demographics and development sectors. Eisenhut et al. (2020) found that significant.

portion, 82.46%, of the reviewed apps were tailored for VAW sufferers, predominantly women. The term 'victims' encompasses both survivors and individuals at risk. Furthermore, 77.19% of these apps originated from the private sector, spanning a spectrum of non-governmental entities including both for-profit and non-profit organizations, while the public sector refers to government agencies.

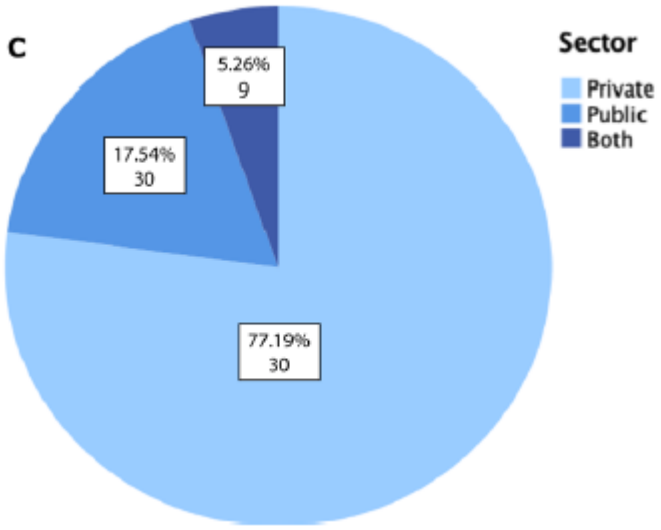

Figure 1. Apps from various sectors

Most of the apps examined in this assessment were freely available for download, without in-app purchases. However, in some cases, the costs were unknown, attributing to the search methodology utilized in this review. These insights into target demographics and sector involvement shed light on the diverse landscape of VAW apps, emphasizing accessibility, sectoral origin, and collaborations between private and public entities.

Statistical analysis, as depicted in Figure 2 by Eisenhut et al. (2020), indicates significant shifts in app category distribution across various regions. Emergency apps emerged as the most popular functional category in numerous areas, aligning with global download trends, particularly evident on resale platforms where they constituted the most procured type.

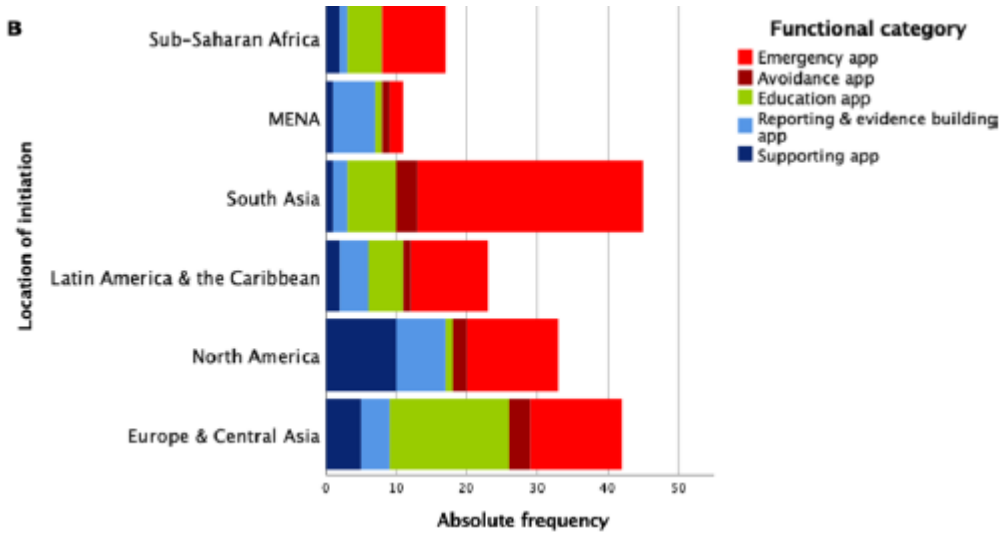

Figure 2. Changes in App category distribution.

Moreover, the breakdown of functional app types and sectoral engagement revealed further disparities. Eisenhut et al. (2020) noted that private companies primarily developed emergency apps, with a staggering eightfold increase in development rates observed globally between 2010 and 2018. Supporting this growth, supporting, reporting, evidence-building, and educational apps have also seen an uptick. However, the dynamic nature of app functionality suggests an evolving development landscape over time.

The significance of these apps lies in their potential to address VAW beyond traditional interventions. With 55%–95% of women hesitant to report violence in person, even with non-mHealth interventions, reporting and evidence-building apps with anonymous reporting features may help mitigate reporting barriers. Additionally, apps and other Information and Communication Technologies (ICT) facilitate easy access to information, particularly in multiple languages, thereby bridging health information gaps for individuals with limited access.

The utilization of mHealth tactics, as evidenced by these apps, proves beneficial, especially for populations lacking direct healthcare access, such as underserved rural communities in low-income and middle-income countries (LMICs). Despite smartphone ownership being less prevalent in LMICs compared to developed nations, studies indicate their increasing use for seeking assistance against violence. However, the prevalence of phone-sharing in LMICs, predominantly among spouses, families, or communities, underscores potential safety implications requiring further exploration.

While emergency apps dominated the evaluation, critical analysis suggests a bias towards specific, one-time interventions for isolated violent episodes. This focus, particularly noticeable in private sector apps from regions like South Asia with higher VAW rates, underscores the need for a more comprehensive approach addressing the structural complexities of violence against women.

Recent app developments have begun adopting preventative and inclusive mHealth strategies against VAW, as depicted in Figure 3C, which illustrates a shift towards apps exploring the societal and structural underpinnings of VAW. This aligns with the socio-ecological framework, which posits that individual, relational, cultural, and social factors collectively influence the likelihood of experiencing or perpetrating violence.

Effective interventions against VAW must address these multi-level factors, which many existing apps currently overlook, as indicated by a global underrepresentation of teaching, reporting, evidence-building, and supportive applications. However, incorporating these elements into mHealth interventions could significantly enhance their impact on reducing violence against women.

Furthermore, there's a notable lack of attention towards changing men's attitudes and behaviours in VAW prevention efforts, representing a critical gap in current approaches. Additionally, access to these apps, especially in LMICs, remains a challenge, necessitating strategies to overcome barriers to dissemination and usage.

Privacy concerns emerge as a significant factor influencing safety app downloads, emphasizing the importance of addressing user privacy and security to foster wider adoption. Multifaceted approaches are needed to increase awareness and usage of safety apps, including effective app development, user education, and accessible information dissemination.

Despite the potential benefits of safety apps, the study highlights disparities in awareness and usage, particularly among young, well-educated women. Addressing these gaps requires targeted education and promotional efforts, as well as inclusive policies to ensure equitable access to technology and its benefits.

In conclusion, while mobile applications offer promising avenues for combating VAW, there remain challenges in ensuring their effectiveness, accessibility, and inclusivity. Addressing these challenges requires a concerted effort from developers, policymakers, and educators to leverage technology responsibly towards creating safer and fairer environments for women worldwide.

Research Methodology

The mobile application safe hood surfaced as a creative reaction to the startling global incidence of violence against women (VAW). According to data from the World Health Organization (WHO), 30% of women worldwide have been victims of physical or sexual abuse by an intimate partner or other person, highlighting the critical need for efficient intervention strategies. Because of the widespread occurrence of sexual abuse, Safe-hood was created as a mobile application that helps women in emergency situations. The app's layout is in line with the alarming fact that more than 25% of women in relationships between the ages of 15 and 49 have experienced physical or sexual abuse at the hands of their significant other at least once in their lifetime. [6]

This survey was conducted in response to data indicating that a sizable portion of women (6%) report having been sexually assaulted by people other than their partners. These figures highlight the gravity of violence against women (VAW), which is primarily committed by men. Positioned as a specialized mobile application, Safe hood is a crucial tool in tackling this intricate problem. The conclusion reaffirms the belief that the advancement and broad use of this technology are essential to promoting women's safety and increasing awareness, especially in the UK. Safe hood, which makes use of the widespread availability and usability of mobile applications, is a concrete and significant step in the direction of reducing the incidence of violence against women in communities across the globe.

The Safe-hood app made use of well-known smartphone technologies to enable an SOS mode that could be triggered by short gestures. When a user is in immediate danger, it enables them to instantly alert friends, family, and local authorities, giving them vital information about where they are and how they are doing. The application is essential to improving society's general sense of security. The use of the SOS mode helps authorities respond quickly and fulfils the crucial role of gathering evidence, which comforts the victim and facilitates further inquiries into the occurrence. Through the seamless integration of technology and personal safety, Safe-hood has proven its ability to enhance people' lives by providing a dependable and workable solution to reduce the risks connected with violence against women.

Methodology SDLC

The Agile Software Development Life Cycle (SDLC)[7] served as the research methodology for creating Safe hood, a mobile application addressing violence against women (VAW) in communities. Due to its focus on delivering high-quality software at minimal cost and time, the agile SDLC was deemed most suitable for this endeavour.

Initial data collection in the first phase gathered crime statistics related to sexual harassment, abuse, and rape across three distinct cities. This comprehensive dataset formed the project's foundation, necessitating meticulous attention to ensure thorough coverage. Concurrently, leveraging a GPS system facilitated efficient app development, aiding in identifying safe and risky areas.

The primary processes involved data collection and software design to meet the intricate specifications for addressing women's safety concerns, encompassing testing, deployment, and architectural planning. Recognizing the potential for iterative enhancements through user feedback, a basic prototype was swiftly developed based on rapid design principles, adhering to standard workflows in mobile app development. The study adopted a three-phase sequence akin to the System Development Life Cycle (SDLC). The initial stage involved in-depth research and analysis of VAW issues, along with proposed solutions. Building upon insights gained, the second stage focused on user interface design and app development. Stage three encompassed rigorous testing and evaluation to ensure Safe-hood's effectiveness and resilience in tackling the pressing issue of VAW.

The inception of the Safe-hood smartphone application marked the study's initiation, preceded by extensive planning and analysis to combat VAW. Research into sexual harassment and violence against women shaped project objectives and specifications. Given Android's popularity and openness in the UK, it was chosen as the platform, informed by insights from existing apps and feedback on women's safety. Utilizing Android Studio as the official Integrated Development Environment (IDE) expedited the development process, although challenges arose, including prolonged rebuild times and adjustments required for display compatibility.

Various IDEs, such as Android Studio and Eclipse IDE, were employed alongside the Android Software Development Kit (SDK) to streamline application development and testing across different Android versions. Despite enhancing visualization through an emulator, dynamic work environments posed challenges, necessitating manual platform downloads. The Android Emulator, while facilitating testing on virtual devices, encountered performance issues, impacting responsiveness and user experience, prompting the study to address these concerns for Safe-hood's optimal operation.

Available application reviews

Holie Guard

Introducing Hollie Guard, a cutting-edge safety app revolutionizing personal security. With real-time location tracking updated every 5 seconds, Hollie Guard ensures swift identification in emergencies. It functions as a multi-purpose alarm, deterrent, and evidence collector, surpassing traditional safety devices. Activating an alert is as simple as pressing and holding a button, triggering the camera, and notifying pre-defined emergency contacts. For extra security, Hollie Guard Extra forwards alerts to a 24/7 police-approved monitoring centre. The Meeting Timer enhances safety in risky situations, requiring users to mark themselves safe or trigger an alert. During crises, Hollie Guard activates the smartphone's camera and microphone for real-time evidence gathering, securely stored in the cloud. The Journey feature monitors trips and notifies contacts upon safe arrival or alert activation. Privacy is paramount, with users retaining control over location sharing. Stay protected and empowered with Hollie Guard, your ultimate safety companion.

Pros:

1. **Enhanced Personal Safety:** Holie Guard provides users with a sense of security by offering features like emergency alerts, location tracking, and quick access to emergency services.
2. **User-Friendly Interface:** The app is designed with simplicity in mind, making it easy for users to navigate and utilize its features even in stressful situations.
3. **Customization Options:** Users can personalize their experience by setting up profiles with specific preferences, including emergency contacts and preferred emergency response methods.
4. **Real-Time Location Sharing:** Holie Guard allows users to share their real-time location with trusted contacts, ensuring they can be easily located in case of an emergency.
5. **Integrated Emergency Services:** The app seamlessly integrates with emergency services, enabling users to quickly connect with authorities or medical assistance when needed.

Cons:

1. **Reliance on Technology:** The effectiveness of Holie Guard is contingent upon stable internet connectivity and functioning GPS services, which may not always be available in all locations or situations.
2. **Privacy Concerns:** Users may have concerns about the privacy implications of sharing their location and personal information with the app, especially if data security measures are not adequately addressed.
3. **Battery Drain:** Constant use of features like location tracking and real-time communication can lead to significant battery drain, potentially limiting the app's usability during prolonged emergencies.
4. **False Alarms:** The app may occasionally trigger false alarms or emergency alerts due to user error or technical glitches, which could lead to unnecessary panic or confusion.
5. **Limited Accessibility:** Holie Guard may not be accessible to all users, particularly those without smartphones or internet access, potentially excluding vulnerable populations from accessing its safety features.

PeopleSafe

UK-based safety provider offers tailored solutions for all workplace safety needs. Our PeopleSafe Mobile App streamlines communication and centralizes safety data, simplifying processes and enhancing efficiency. With user-friendly interfaces and step-by-step protocols, PeopleSafe fosters a culture of safety and capability-building, creating safer work environments. GPS Location Sharing functionality enhances emergency communication, particularly benefiting women's safety. Empower yourself with PeopleSafe for peace of mind and security in any environment.

Pros:

1. **Tailored Safety Solutions:** PeopleSafe offers personalized safety solutions for various workplace scenarios, catering to the specific needs of employees in high-risk and low-risk environments.
2. **Centralized Information:** The app consolidates all safety-related information in one place, making it easily accessible and preventing loss or confusion.

3. **Comprehensive Data Storage:** PeopleSafe serves as a central hub for storing crucial safety data, including People Records, Safety Event (Story) Records, Training Records, Safety & Emergency Plans, and Gear & Equipment Records, ensuring comprehensive documentation.
4. **Efficient Communication:** Communication is streamlined through the mobile app, facilitating seamless dissemination of safety information to team members, volunteers, or contractors.
5. **User-Friendly Interface:** The app features user-friendly interfaces and step-by-step processes, replacing outdated safety approaches with easy-to-understand protocols, thereby enhancing safety compliance and implementation.
6. **GPS Location Sharing:** The GPS Location Sharing functionality allows users to share their real-time location with designated contacts, enhancing emergency communication and response efforts, particularly beneficial for women's safety and proactive threat prevention.

Cons:

1. **Dependence on Technology:** The effectiveness of PeopleSafe relies on stable internet connectivity and functioning GPS services, which may not always be available in all locations or situations, potentially limiting its usability during emergencies.
2. **Privacy Concerns:** Users may have concerns about privacy and data security, especially regarding the storage and sharing of personal information and location data within the app.
3. **Learning Curve:** Some users may experience a learning curve when initially using the app, especially if they are not familiar with mobile technology or digital safety platforms, potentially impacting adoption rates and user satisfaction.
4. **Cost:** Depending on the pricing model, the cost of using PeopleSafe may be a deterrent for some organizations, especially smaller businesses, or non-profit organizations with limited budgets.
5. **Compatibility Issues:** PeopleSafe may not be compatible with all devices or operating systems, potentially excluding certain users from accessing its safety features, especially if they use older or non-standard devices.

bSafe

bSafe is a personal safety app designed to prevent violence and provide immediate assistance. It sends distress signals to pre-selected contacts with the user's GPS location during emergencies. The Live Streaming feature share real-time location with trusted friends, enhancing safety. A Fake Call feature helps users escape dangerous situations discreetly. bSafe's holistic approach combines innovative technology with practical safety measures, benefiting individuals, workplaces, and communities. It contributes to reduced crime, violence, and sexual assaults, improving employee safety and service quality. By facilitating collaboration between users, businesses, emergency centres, and authorities, bSafe enables shorter emergency response times and safer communities, aligning with the United Nations' Sustainable Development Goal 16.

Pros:

1. **Preventative Safety Measures:** bSafe is designed to prevent violence and offer immediate assistance, providing users with essential safety tools to enhance personal security.
2. **Distress Signal with GPS Location:** The app's primary function involves sending distress signals to pre-selected contacts along with the user's GPS location, which can effectively save lives during emergencies by enabling swift assistance.
3. **Live Streaming Feature:** bSafe's Live Streaming feature allows users to share their real-time location with trusted friends, adding an innovative layer of protection by keeping them informed of the user's whereabouts and deterring potential threats.
4. **Fake Call Feature:** The Fake Call feature enables users to discreetly simulate incoming calls, providing a way to escape uncomfortable or dangerous situations while enhancing their sense of security and control.
5. **Holistic Approach to Safety:** With its combination of innovative technology and practical safety measures, bSafe serves as an invaluable ally for individuals seeking proactive violence prevention and aid.

Cons:

1. **Dependence on Technology:** The effectiveness of bSafe relies on stable internet connectivity and functioning GPS services, which may not always be available in all locations or situations, potentially limiting its usability during emergencies.
2. **Privacy Concerns:** Users may have concerns about privacy and data security, especially regarding the storage and sharing of personal information and location data within the app.

3. **Learning Curve:** Some users may experience a learning curve when initially using the app, especially if they are not familiar with mobile technology or digital safety platforms, potentially impacting adoption rates and user satisfaction.

DEVELOPMENT

Project Planning

Project planning involves organising tasks and schedules to achieve specific objectives within a defined frame time. For this purpose, a key tool used is a Gantt Chart, which visually represents project tasks, timelines, dependencies, and milestones. This chart consists of horizontal bars for each task, spending its estimate duration along a timeline represented on the charts X-axis. Represented tasks on a Gantt chart is to visualise the entire app development cycle. It helps allocate resources efficiently, manage tasks, track progress, and meet deadlines affectively. Regular updates to the Gantt chart facilitate transparent communication and alignment among project stakeholders, ensuring the successful delivery of high-quality app that meets users' expectation and business objectives.

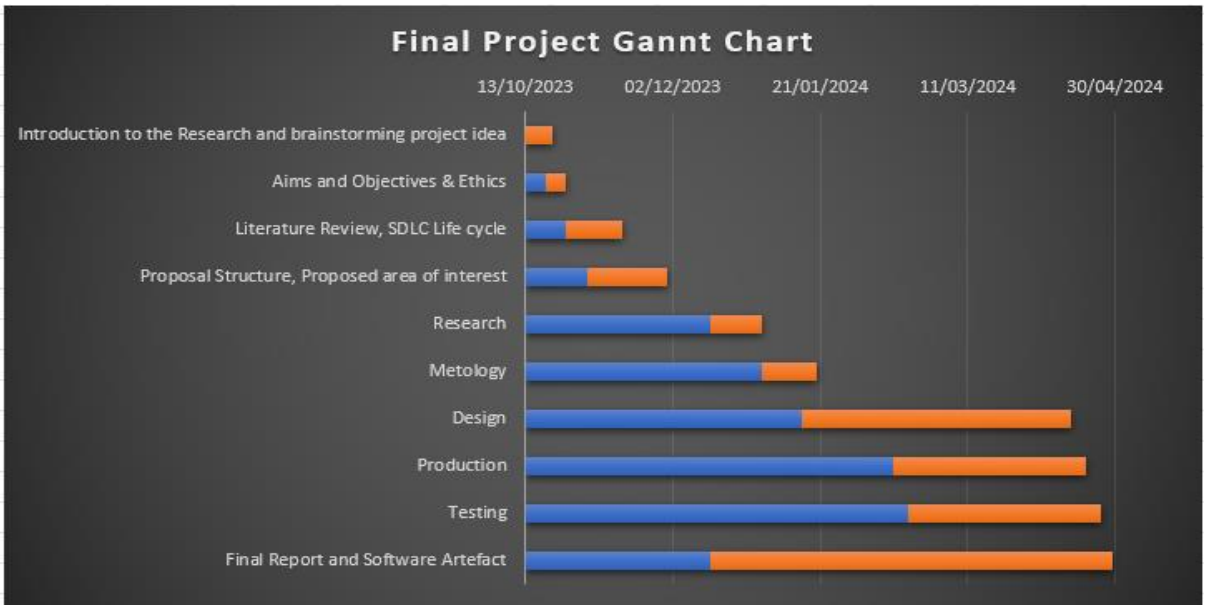

Figure 3. Gannt Chart.

- **Production to research**- This initial phase involves defining the apps concept, objectives, and target audience. Nine days are allocated to this critical stage, ensuring a clear understanding of project goals and user's needs.
- **Aims and objectives**-Seven days are dedicated to clearly define the aims and objectives of the app, setting a focus direction for the development process.
- literature review- the research phase includes conducting a comprehensive literature review, requiring 19 days to gather insights and information relevant to the app's domain.
- **Proposal structure**- With 27 days allocated the proposal structure is developed, outlining the projects framework and methodology.
- research-this phase involves 17 days of dedicated research activities, gathering data and information essential for informing app development decisions.
- **Methodology**-With 19 days allocated, the methodology is defined, establishing the approach and progress to be followed during development.
- **Design**-The design phase is substantial, which 91 days allocated for creating wire frames, markups, end user interface that align with project objectives and user expectations.
- **Production-development-** Activities spend 65 days, focusing on coding integration add feature implementation to build the app according to the design specifications,
- **Testing**- An equal duration of 65 days is allocated for rigorous testing, ensuring the app functions properly, is user friendly, and meets quality standards.
- **Final report**- the project culminates with the final report, outcomes and any recommendations for future enhancements or iterations.

This structured approach ensures that every facet of app development, from conceptualization to final reporting, is meticulously addressed. By adhering to the roadmap delineated in the Gantt Chart, teams can navigate the complexities of app

development with clarity, efficiency, and effectiveness, ultimately delivering a high-quality app that fulfils objectives and user needs. Regular updates to the Gantt Chart facilitate transparent communication and alignment among project stakeholders, ensuring the project stays on course towards successful delivery.

Design

A thorough dissection of the user interaction process revealed the methodical orchestration of the Android app's system architecture. The user's password and email address were verified upon login, and if there were any inconsistencies, the login screen would be redirected. A user-friendly experience was produced by the application's smooth transition between the main screen and the login screen. During the sign-up procedure, new users had to provide basic details including their email address, phone number, password, and username. It was clear that robust error handling ensured a seamless registration procedure. Current user detection systems made it easier to take the necessary action, such as directing already registered users to the login screen and requiring new users to complete the registration procedure. The Safe-hood application's architecture incorporates security considerations. [8]

and technical skill, as demonstrated by the integration of Firebase Real Time Database to handle user information and authentication.

The SOS function of the Safe-hood mobile application allowed users to contact emergency numbers like 999 and 112. Notably, users could easily navigate back to the main screen by cancelling the SOS activation if it was accidentally triggered. The tracking activity diagram showed effective functionality. For example, when a user selected the share location status option, the system received the user's member list, current location, and shared the location with that user. In Google's Firebase database, the choice to store data using JSON trees rather than conventional SQL worked well for preserving coherence. For example, this design made it easier to create a structured entry in Firebase after user registration. This feature set and design made a significant contribution to Safe-hood's overall efficacy in combating violence against women in the community.

In conclusion, Safe-hood's development journey, guided by the agile SDLC, underscored the importance of meticulous planning, iterative design, and addressing technical challenges to create a robust solution for combating violence against women.

Safe-hood Mobil App Prototype

To provide victims with timely updates, the Safe-hood mobile application prototype acted as a centralized platform that was used by women and emergency responders to efficiently track and manage VAW situations. The user experience of the mobile app was notably designed with women in mind, prioritizing a user-centric approach. By requiring users to register or log in, the application's security and customization features were improved.

This integrated solution marked a major advancement in the use of technology to improve the safety and support systems accessible to women in the community who are dealing with similar difficulties.

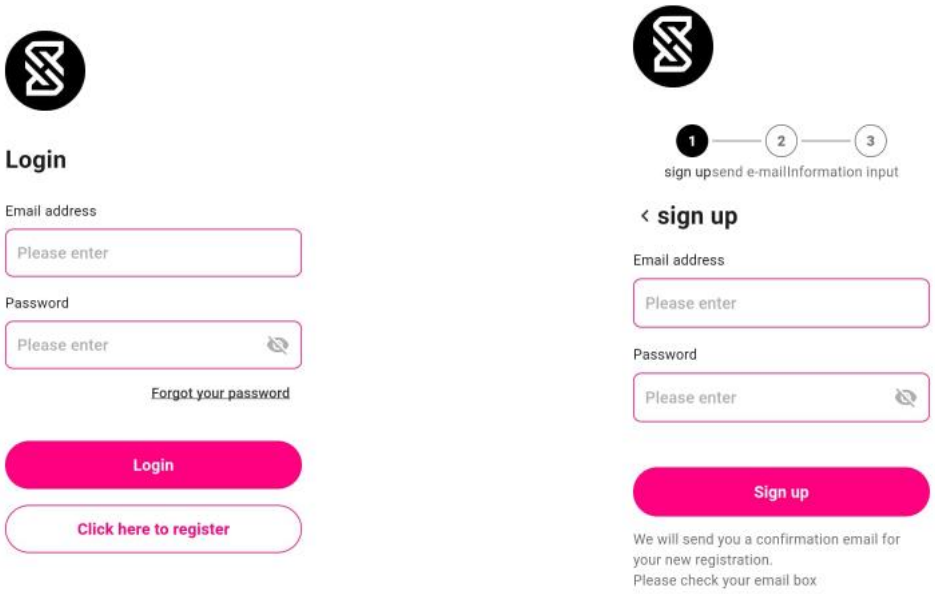

Figure 4: Sign up and Login screens.

The prototype for the Safe-hood mobile application was painstakingly created and put into use to address violence against women (VAW) in the neighbourhood. Users were prompted to register using a

UI that asked for personal information such name, email address, password, and mobile number after clicking the app icon. An option to sign in was accessible for current users, which took them to the login screen. Through the sign-up page, new users could easily register an account. Email addresses and passwords were required for future Firebase authentication attempts. The Firebase Realtime Database was essential in preserving the distinct user ID. It had hosting, storage, and authentication features that authorities could view on a special webpage. With the help of this database feature, managers were able to keep a close eye on and record user behaviour, providing valuable information about the users of the program. The incorporation of these functionalities highlights the Safe-hood application's practical relevance and strong technical foundation in reducing violence against women within the community.

Figure 5: Main menu

For the app to function properly, the live location functionality required to be enabled after the user account had been set up. Users could see their current position on their screen after it was enabled. After a successful login, the main menu displayed buttons for several functionalities. Real-time location viewing was made easier with the 'my location' button. Users may make any necessary changes to their profile using the 'my profile' button, and to improve community safety and responsiveness, they could publish their location on any platform by using the 'share location' button. The Safe-hood prototype combined technical features for both instant reaction and prevention to present a comprehensive and user-friendly strategy to address violence against women.

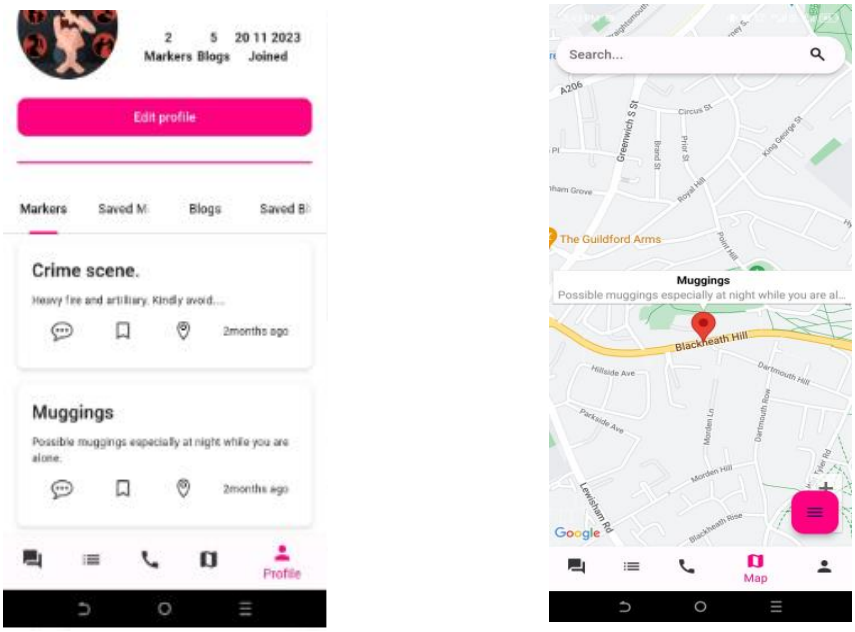

Figure 6: Profile and Location feat

The prototype for the Safe-hood mobile application produced encouraging results in terms of use and functionality. Users can effectively communicate their current position with specific contacts by utilizing the "Share Location" feature, which exhibits a smooth interface integration. Upon activation, a nice interface asked to choose the preferred sharing platform, after which a Google Maps link was created and forwarded to the selected friend. Recipients were taken to Google Maps, which displayed the user's exact location and movements, upon clicking the link. By allowing users to notify trusted contacts of their whereabouts, this feature improves personal safety and promotes security in a variety of scenarios.

With the successful implementation of the "My Location" function, users may easily check their current position. Heatmap integration would bring a level of sophistication to future work and enable users to evaluate the safety of their environment.

Users would be able to make wise judgments about where to go in the community by using the color-coded indication, where red indicates locations with the highest crime rates. Through this integration, users would be able to traverse their surroundings more securely and the Safe-hood application would become a more proactive tool for risk assessment.

It was found that the "SOS mode" function worked well for responding to emergencies. Direct access to emergency services was made possible by the application's emergency call buttons. Users were given the opportunity to cancel the call, ensuring a conscious and controlled activation of the SOS mode, to prevent accidental calls resulting from inadvertent dialling. Furthermore, the user profile administration feature, which was obtainable via the main menu, showed dependability. The Firebase database synchronization made it possible for users to easily update their profile information, and it guaranteed that these changes would be reflected consistently throughout the application, improving the overall dependability and integrity of user data in Safe hood.

Production:

Front End- General public usage, such as UI development

Research we love rich flatter for front end development to enhance scalability and reduce costs. Flatter, an open-source framework backed by Google, is widely embraced by both front end and full stack developers for building users' interface (UI) across multiple platforms using a unified code base. This approach streamlines the creation of visually appealing and consistent UIs for applications spanning Android, IOS, Mac OS, Windows, web, and Linux platforms.

By adapting Flutter, the research aims to capitalise on its versatile capabilities. Flatters key advantage lies in its ability to accelerate development process is while maintaining UI integrity across diverse platforms. This ensures that developers can focus on refining users experience without the need to manage desperate code bases from different operating systems.

One of the primary benefits of using Flutter is its cost of efficiency. This consolidation not only optimises resource allocation but also expedites time to market by simplifying the development lifecycle.

Moreover, flatter adaptability and scalability are vital for research endeavours aiming to evolve or expand applications over time. This frameworks compatibility with emerging technologies and its robust support from Google and the developer community offers insurance of long-term viability.

Back and Front End

Backend

We have decided to adopt the route of using Backed as a Service (BaaS) provider/ using the services of Google Firebase and Cloud services to host the database. The following are the Firebase products used.

i. Firebase Authentication- Authentication is a Firebase feature offering ready-to-use UI libraries, backends, and convenient SDKs for user application authentication. Authentication is supported through phone numbers, passwords, and providers such as Google, Twitter, Facebook, and others.

ii. Firebase Cloud Firestore- It is fundamentally a cloud-based NoSQL database for data storage and synchronization. Firebase users can access Firestore from the mobile or web applications via native SDKs.

iii. Cloud Storage-The Cloud Storage feature of Firebase is a service for storing application development resources, including objects. Users gain access to Google-level upload and download security with this feature, and it is suitable for storing media files and user content.

iv. Crashlytics-Crashlytics is Firebase's Realtime crash reporter that enables developers to track issues, prioritizing them, and addressing them. The Crashlytics feature can be used to prevent possible stability issues.

v. Google Maps API- To enable us use Google Maps features in the front end.

2.0 Front End- General public usage i.e., UI development

For ease of scalability and cost reduction, we have adopted Flutter develop the front end.

Flutter is an open-source framework developed and supported by Google. Frontend and full-stack developers use Flutter to build an application's user interface (UI) for multiple platforms with a single codebase. It simplifies the process of creating consistent, appealing UIs for an application across the six platforms it supports i.e, Android, IOS, MACOS, Windows, Web, and Linux.

Data Base

Database management relied on Firebase, offering a robust backend infrastructure with services like analytics, authentication, and real-time data management. Although beneficial, compatibility issues with Firebase versions necessitated frequent updates to ensure optimal performance and compatibility with evolving frameworks. This underscored the importance of staying updated to maintain Safe-hood's efficacy.

A strong architecture was incorporated into the Safe-hood system design to enable the full integration of user data, especially the location determined by the smartphone's GPS capabilities. By utilizing the Google Maps API key, the system was able to share the user's current position with contacts that they had registered, which allowed for important features like emergency SOS calls, heat maps, and simulated calls. The smooth and responsive user experience was made possible by the methodical incorporation of user inputs and outputs, which in turn made these functionalities efficient. The system was strengthened even more by utilizing the Firebase Real Time Database, which offered a backend infrastructure for managing online users, their location, and the verification procedure.

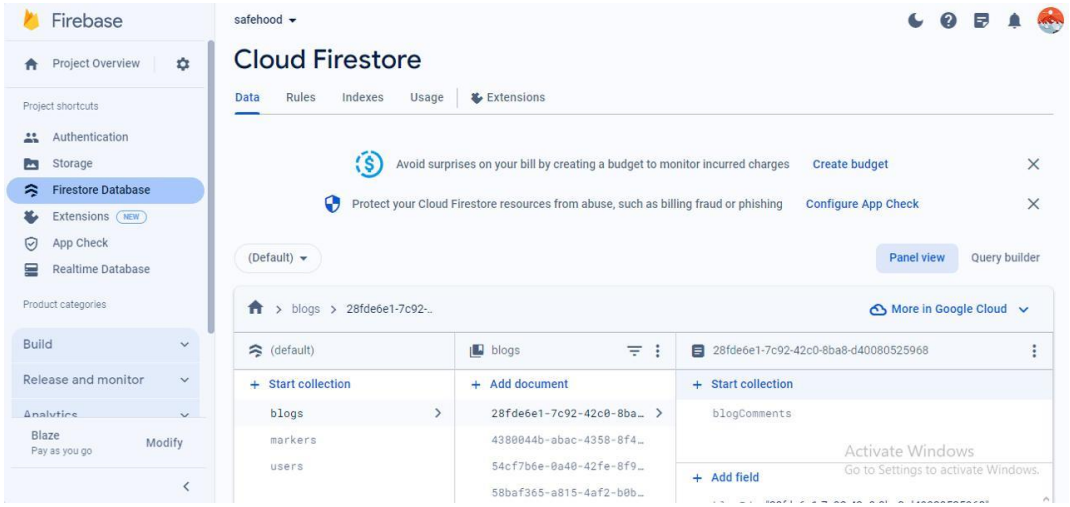

Figure 7: Fire Base Database Back End

Testing, App Test Results

According to user input, most respondents lacked self-defence gear or devices, which indicates a weakness in their defence against possible dangers. A large proportion of UK women do not take preventive measures, which increases their risk of sexual harassment and abuse given the high rates of criminality directed towards women. Only 19 respondents admitted to carrying personal alarms and pepper spray, according to their reported inventory of safety equipment; the majority said they carried nothing at all. This substantial disparity in readiness points to the urgent need for programs that enable women to improve their own security. The study results and the statistics point to a clear gap in women's safety awareness and preparedness, which begs the urgent need for novel solutions like the Safe-hood smartphone application.

Moreover, user ratings revealed a complex picture of the incidence of violence against women in the UK, with an average score of 2.38 out of 5. Participants agreed that the instances had not escalated to an alarming degree, but they did underline the need for proactive steps to stop them from happening in the future. It was clear that women safety applications were well received; 29 out of 32 respondents said they were useful. This highlights the unrealized potential for safety apps designed with UK women's context in mind. When asked if they would be interested in taking part in app testing, the following inquiry was met with enthusiastic responses from participants, all of whom indicated that they would be eager to participate and gave their email addresses for future communication. This involvement not only shows how valuable people think the Safe-hood application is, but it also lays the groundwork for teamwork in improving the application's quality and functionality through practical testing.

It is essential to recognize some of the difficulties that were faced during the system's creation and upkeep. One significant problem is with real-time database management, where Firebase's distinct structure makes it difficult to maintain and govern the database. There could be challenges for developers, particularly when switching from standard SQL databases to Firebase's tree-dimensional structure. Even with online lessons readily available, different compilation configurations can produce a different programming environment, which may present challenges during the development process. By addressing these issues, such as by improving database management structure or developer support, the Safe-hood application's robustness and dependability could be further strengthened, assuring its ongoing efficacy in preventing violence against women in the community.

CONCLUSION AND FUTURE WORK RECOMMENDATIONS

Conclusion and Implication

The mobile application safe-hood surfaced as a creative reaction to the startling global incidence of violence against women (VAW). According to data from the World Health Organization (WHO), 30% of women worldwide have been victims of physical or sexual abuse by an intimate partner or other person, highlighting the critical need for efficient intervention strategies. Because of the widespread occurrence of sexual abuse, Safe-hood was created as a mobile application that helps women in emergency situations. The app's layout is in line with the alarming fact that more than 25% of women in relationships between the ages of 15 and 49 have experienced physical or sexual abuse at the hands of their significant other at least once in their lifetime.

This survey was conducted in response to data indicating that a sizable portion of women (6%) report having been sexually assaulted by people other than their partners. These figures highlight the gravity of violence against women (VAW), which is primarily committed by men. Positioned as a specialized mobile application, Safe-hood is a crucial tool in tackling this intricate problem. The conclusion reaffirms the belief that the advancement and broad use of this technology are essential to promoting women's safety and increasing awareness, especially in the UK. Safe-hood, which makes use of the widespread availability and usability of mobile applications, is a concrete and significant step in the direction of reducing the incidence of violence against women in communities across the globe.

The Safe-hood app made use of well-known smartphone technologies to enable an SOS mode that could be triggered by short gestures. When a user is in immediate danger, it enables them to instantly alert friends, family, and local authorities, giving them vital information about where they are and how they are doing. The application is essential to improving society's general sense of security. The use of the SOS mode helps authorities respond quickly and fulfils the crucial role of gathering evidence, which comforts the victim and facilitates further inquiries into the occurrence. Through the seamless integration of technology and personal safety, Safe-hood has proven its ability to enhance people' lives by providing a dependable and workable solution to reduce the risks connected with violence against women.

Impact and Contribution

In response to the shortcomings of current emergency applications—which frequently need subscription fees for additional features—Safe-hood was created. In contrast to other substitutes, Safe-hood offers an entirely free option, guaranteeing accessibility to a wider audience, especially helping women who might be struggling financially. Beyond just monitoring features, the software allows users to evaluate the safety of their travel routes by pinpointing possible high-risk locations. The SOS emergency alert feature is noteworthy as it enables users to promptly seek assistance in risky situations and proactively mitigate potential hazards. Due to the shift in the economy, where women are working longer hours, they need solutions like Safe-hood to help them manage their everyday tasks securely. In addition to acting as a preventive measure, the application gives users a sense of security and raises their awareness of potential threats in their immediate surroundings.

Impact and contribution-wise, Safe-hood supports the main objective of safety applications by instantly alerting those who can respond quickly. By doing this, it greatly contributes to keeping women safe from assault and encourages a proactive attitude toward personal safety. This application shows how technology can be used practically to improve women's security and signals a paradigm shift in the way that violence against women is addressed. Even though women's security apps may not be given as much attention in today's security environments, Safe-hood's continued use, frequent updates to meet changing needs, and growing public awareness of security issues all point to a promising future for these apps and the possibility that they will play a more significant and morally significant role down the road.

Ethical consideration

Ethical considerations are paramount in the study of Violence against Women (VAW) due to its sensitive nature. The research will adhere to the ethical and safety norms outlined by the World Health Organization (WHO) for the investigation, recording, and monitoring of VAW crises, ensuring the utmost confidentiality and anonymity [1]. To elucidate the study's purpose, data storage, and usage, a meticulous systematic review of the literature, guided by established protocols [2], will be conducted.

This comprehensive literature survey will empower the research team to carefully select pertinent articles that align with the study's objectives. The draft of the results will undergo rigorous scrutiny to provide valuable insights and feedback on the research questions.

Given the emotional impact of VAW, the research will acknowledge that certain literature may contain records of women who have experienced violence. In such instances, a thorough assessment of distress symptoms and the implementation of pre-established measures for identifying abuse survivors will be conducted, demonstrating a commitment to handling this information with care.

Therefore, the literature surveys will not only contribute to a nuanced understanding of the subject matter but also serve to provide accurate information, offering necessary support and referrals for VAW cases as deemed appropriate. Resources & Planning The inductive analytical inquiry prioritizes developing new theories and conceptual understanding by examining peer-reviewed studies on using mobile apps to mitigate risks. Thematic analysis will uncover patterns and topics, coded, and categorized until topical saturation occurs. Regular comparisons between theoretical framework themes and empirical data will yield fresh theoretical elaborations. Vetted sources, including peer-reviewed publications, books, NGO contributions, UN agencies, and government papers, will be used. The search involves university library tools, Google Scholar, and Google Search, with keywords like VAW, disaster, emergency, crisis, prevention, humanitarian action, risk factor, protective factor, perpetration, and gender. The review will focus on sources from the past ten years, with exceptions for foundational gender theories and the Ecological Model. Due to time and language constraints, only English materials will be considered. A background study on gender equality and VAW will contextualize and structure data collection.

Limitations

It is essential to recognize some of the difficulties that were faced during the system's creation and upkeep. One significant problem is with real-time database management, where Firebase's distinct structure makes it difficult to maintain and govern the database. There could be challenges for developers, particularly when switching from standard SQL databases to Firebase's tree-dimensional structure. Even with online lessons readily available, different compilation configurations can produce a different programming environment, which may present challenges during the development process. By addressing these issues, such as by improving database management structure or developer support, the Safe-hood application's robustness and dependability could be further strengthened, assuring its ongoing efficacy in preventing violence against women in the community.

Future Work

Safe-Hood stands as a beacon of innovation in the realm of safety and community engagement, offering a plethora of customizable features tailored to meet the diverse needs of its users. Let's delve deeper into the array of functionalities that set Safe-Hood apart:

- Customization Options: Safe-Hood understands that each user is unique, with individual preferences and safety concerns. To cater to this diversity, the app allows users to customize their profiles based on factors such as gender, age, and other preferences. This ensures a personalized experience for every user, fostering a sense of belonging and empowerment.
- User Filtering: In today's digital age, safety and security are paramount. Safe-Hood's robust user filtering capabilities empower users to filter content and interactions based on their preferences and safety needs. Whether it's blocking unwanted messages or limiting interactions to trusted contacts, users have full control over their digital experience, ensuring peace of mind.
- Easy Topic Search: Navigating through vast amounts of information can be daunting. Safe-Hood simplifies this process with its powerful search function, enabling users to quickly find relevant topics or discussions within the app. This enhances usability and efficiency, allowing users to access information swiftly and effortlessly.
- 24-Hour Admin Support: Safety knows no bounds, which is why Safe-Hood provides users with access to 24-hour admin support. Whether it's addressing technical issues or resolving safety concerns, users can rest assured knowing that prompt assistance is just a click away. This commitment to customer support fosters trust and confidence among users, reinforcing Safe-Hood's dedication to safety and reliability.
- Multilingual Support: Diversity is celebrated in Safe-Hood's community, and language should never be a barrier to safety. That's why Safe-Hood supports multiple languages, ensuring inclusivity and accessibility for users from all walks of life. By breaking down language barriers, Safe-Hood fosters a sense of unity and cohesion among its global user bases.
- Profile Setup: Personalization is key to a fulfilling user experience, and Safe-Hood understands this implicitly. Users can set up their profiles with customizable features such as choosing colours, themes, and other preferences. This not only enhances the aesthetic appeal of the app but also allows users to tailor their experience according to their unique tastes and preferences.
- Emergency Diary Feature: In times of crisis, quick and effective communication can be a lifeline. Safe-Hood's emergency diary feature enables users to record audio or video clips along with GPS location data, providing vital information to emergency responders. Users can also grant access to their device's microphone, speaker, and cameras for enhanced communication and documentation. These recordings can be securely stored and shared with designated emergency contacts for immediate assistance, ensuring rapid response in critical situations.

- Premium Features: For users seeking an elevated experience, Safe-Hood offers premium features through a payable option. This includes functionalities such as ad removal, 24/7 GPS tracking, and more, providing added convenience and peace of mind to users who opt for these enhanced capabilities.
- NFC Integration: Safe-Hood harnesses the power of Near Field Communication (NFC) technology to facilitate seamless interactions. Users can quickly share information or connect with other users or emergency services in proximity using NFC-enabled devices, further enhancing safety and communication capabilities.

In essence, Safe-Hood's comprehensive features empower users to feel safer and more secure in their communities. By providing a customizable and user-friendly experience that caters to the diverse needs of its users, Safe-Hood remains at the forefront of safety innovation, forging connections and fostering resilience in an ever-changing world.

REFERENCES

[1] Office for National Statistics, “Violence against Women and Girls - Office for National Statistics,” 2021. https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/articles/violenceagainstwomenandgirls/researchupdatenovember2023

[2] UN Women, “Facts and figures: Ending Violence against Women,” *UN Women*, Sep. 21, 2023. https://www.unwomen.org/en/what-we-do/ending-violence-against-women/facts-and-figures

[3] Statista, “UK Global Peace Index Score 2023,” 2023. https://www.statista.com/statistics/1396052/uk-global-peace-index-score/

[4] W. Niroo and H. Crompton, “Women’s Empowerment through Learning Using Technology,” *Asian Journal of Distance Education*, vol. 17, no. 2, 2022, Available: https://files.eric.ed.gov/fulltext/EJ1373932.pdf

[5] K. Eisenhut, E. Sauerborn, C. García-Moreno, and V. Wild, “Mobile Applications Addressing Violence against women: a Systematic Review,” *BMJ Global Health*, vol. 5, no. 4, Apr. 2020, doi: https://doi.org/10.1136/bmjgh-2019-001954.

pp. 812–821, Nov. 2021, doi: https://doi.org/10.1007/s11524-021-00580-9.

[6] World Health Organisation, Violence against woman. 25th of March.2024, Violence against women (who.int)

[7] Samar Al-Sagga, Samer Sawalha, Hiba Abdel-Nabi, Article- Agile Software Development: Methodologies and Trends, July 2020International Journal of Interactive Mobile Technologies (iJIM) 14(11):246

[8] K. Ford, M. A. Bellis, N. Judd, N. Griffith, and K. Hughes, “The Use of Mobile Phone Applications to Enhance Personal Safety from Interpersonal Violence – an Overview of Available Smartphone Applications in the United Kingdom,” *BMC Public Health*, vol. 22, no. 1, Jun. 2022, doi: https://doi.org/10.1186/s12889-022-13551-9.

APPENDIX

Safe-Hood Source code:

```
plugins {
    id "com.android.application"
    id "kotlin-android"
    id "dev.flutter.flutter-gradle-plugin"
}

def localProperties = new Properties()
def localPropertiesFile = rootProject.file('local.properties')
if (localPropertiesFile.exists()) {
    localPropertiesFile.withReader('UTF-8') { reader ->
        localProperties.load(reader)
    }
}

def flutterVersionCode = localProperties.getProperty('flutter.versionCode')
if (flutterVersionCode == null) {
    flutterVersionCode = '1'
}

def flutterVersionName = localProperties.getProperty('flutter.versionName')
if (flutterVersionName == null) {
    flutterVersionName = '1.0'
}

android {
    namespace "com.example.safehood"
    compileSdkVersion 34
    ndkVersion flutter.ndkVersion

    //if (project.android.hasProperty("namespace")) {
    //     namespace("com.example.safehood")
    //}

    compileOptions {
        sourceCompatibility JavaVersion.VERSION_17
        targetCompatibility JavaVersion.VERSION_17
    }

    kotlinOptions {
      jvmTarget = '17'
    }

    sourceSets {
        main.java.srcDirs += 'src/main/kotlin'
    }

    defaultConfig {
        // TODO: Specify your own unique Application ID (https://developer.android.com/studio/build/application-id.html).
        applicationId "com.example.safehood"
        // You can update the following values to match your application needs.
        // For more information, see: https://docs.flutter.dev/deployment/android#reviewing-the-gradle-build-configuration.
        minSdkVersion 29
        targetSdkVersion 34
        versionCode flutterVersionCode.toInteger()
        versionName flutterVersionName
        multiDexEnabled true
        //manifestPlaceholders['foregroundServiceType'] = 'location'
        //manifestPlaceholders = [
        //    googleMapApiKey: secretProperties.getProperty('AIzaSyDaQMtK1Uff_VATgg6WsvND45ZrzvAfbL4'),
        //    applicationName: secretProperties.getProperty('Safehood'),
        //]
    }

    buildTypes {
        release {
            // TODO: Add your own signing config for the release build.
            // Signing with the debug keys for now, so `flutter run --release` works.
            signingConfig signingConfigs.debug
        }
    }
}

//apply plugin: 'com.google.gms.google-services'

flutter {
    source '../..'
}

dependencies {
}
```

Figure 8. Source code of Sahe-hood