FeelSafe: A Women's Safety and Security System

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Women's safety is regarded as one of the most critical issues faced by women today. Many women feel unsafe when leaving their homes due to the increasing number of crimes in society, such as abuse, harassment, and violence. The business and IT industries are currently thriving, and many women are working in these sectors, often staying late into the night. However, despite these advancements, there remains a sense of insecurity among working women, even during daylight hours. To address this concern, the Women Safety System, called FeelSafe, has been developed to provide women with a sense of security when they are away from home. The system consists of a device equipped with an emergency button. In case of an emergency, a woman simply needs to press this button. Once activated, the system sends an alert message, along with the user's location, to pre-defined emergency contact numbers. Additionally, the person registered as the emergency controller can manage the system using predefined commands. Timely intervention in such situations can help protect women from abuse or harassment. The system has been tested in various environmental settings and has demonstrated adequate accuracy. A testing scenario is presented in Section IV, which illustrates the complete sequence of actions taken by FeelSafe in response to an emergency.

Keywords: Women's Safety, Harassment, Arduino

Introduction:

Women's safety is one of the major challenges of the modern era. Women often feel insecure when they step out of their homes for work, travel, or to visit public places. They face a range of challenges, including immoral behavior and physical harassment. Women's safety and security have long been a focus of researchers across various fields. Women are generally considered at a higher risk of violence in both public and private spheres [1]. This heightened insecurity can limit their access to resources [1]. Women around the world experience violence in many forms, regardless of religion, age, race, or nationality [2]. Study [3] presents a statistical analysis of physical abuse and harassment of women in academic institutions.

Given the seriousness and sensitivity of women's safety issues, many researchers in the field of information technology have turned their attention toward addressing this problem. Various mobile applications have been developed as part of women's protection systems. However, these solutions often have limitations or are not very user-friendly. In this paper, we propose a women's safety and security system named "FeelSafe." FeelSafe is a compact wearable device that can be integrated into clothing, such as a jacket button, a scarf clip, a bracelet, or any other accessory. When a woman senses any unethical behavior around her, she simply needs to press the button. Once activated, the device immediately sends an emergency message to a pre-saved contact number.

After receiving the alert, the designated contact person can control the system via SMS commands. Several commands are pre-programmed into FeelSafe, such as "send location" and "send image." The device interprets these commands and responds accordingly. Another key feature of the FeelSafe system is its automatic call response: after the button is pressed, the victim's phone will automatically answer an incoming call after two rings. This allows the caller to listen in on the surrounding environment, providing critical real-time information.

The goal behind designing the FeelSafe system is to offer a smart, easy-to-use, and stress-free alternative to existing women's security solutions. Some existing systems include the All-in-One Intelligent Women Security System [4], GPS and GSM-Based Self-Defense System for Women Safety [5], FEMME [6], and various mobile applications. However, FeelSafe aims to combine usability, immediacy, and intelligent response to provide a more effective solution.

When a woman is subject to attack by a culprit, she only needs to push the button manually, which can be placed at an ideal location on the body without the knowledge of attacker. In response, the system will send an SOS (emergency) message and a call to alert the concerned person. Afterwards, the concerned person can control the system by sending pre-defined commands. These commands include: send location, image, or short video clip. When the location command is sent, the system will send a Google Maps link through email to the concerned person. The emergency contact can also call the victim, and the call will be answered automatically after two rings, allowing the concerned person to listen to real-time voices and also record the call for evidence.

The FeelSafe system introduces an innovative approach to women's safety by embedding a discreet emergency button into everyday clothing or accessories, eliminating the need for overt mobile phone interaction during distress. Unlike existing mobile-based solutions, FeelSafe minimizes victim exposure and allows the emergency contact to remotely control the device using simple SMS commands. The main objectives of this study are to design a compact, easy-to-use, and efficient women's safety device, ensure rapid communication during emergencies, and enhance evidence collection through real-time location sharing, audio monitoring, and image capturing, thus providing a smarter and more reliable security option for women.

Objectives:

- To design and develop an intelligent women's safety system (FeelSafe**)** that is compact, wearable, and enables quick emergency communication.
- To ensure rapid and reliable communication during distress situations by integrating features such as automated emergency messaging, real-time location sharing via Google Maps, and audio monitoring through auto-call reception.
- To enable remote control of the safety device by a pre-assigned emergency contact using simple SMS-based commands, such as requesting the victim's location, capturing images, or initiating a call.
- To enhance evidence collection and situational awareness by allowing the emergency contact to listen to the surroundings in real time and receive multimedia evidence (e.g., images or videos) from the scene.

Literature Review:

Having the concern of women's safety in mind, we reviewed the literature and found that several researchers in the field of information technology have focused on this sensitive issue. All-in-One Intelligent Safety System for Women Security [4] is an Android application with different modules, including camera detection, calling, an SOS message, and a fake call tool. Women Self-Defense System [5] is comprised of GSM, GPS, and a speaker for women's security purposes, which sends an alert message in danger. FEMME [6] is an Android application that is used to send the location to a group of people whose information is stored in the phone, in case of an emergency. The system is capable of tracking the phone by using a phone button with hidden camera detection, and also records the voice. Advanced Woman Security System based on Android [7] is comprised of a GPS device and an Android phone equipped with an emergency button. The GPS device needs to be placed inside the system, and then the device will be able to provide the location in latitude and longitude. When the emergency button is pressed, the police will get an alert.

An armband in this system, the victim needs to initiate the system, and on initiation, the video will be recorded and live-streamed to the control room. Afterwards, an emergency message along with the location is sent to a pre-set phone number until the system is next reset. The variation in longitude and latitude is continuously sent to the emergency contact, so the victim can be located. Smart Foot System [9] is a smart device that can be equipped in women's footwear and can be activated discreetly by stepping one foot after the other four times. Afterwards, an emergency is triggered through Bluetooth to an application on the victim's mobile, which is programmed to create a message requesting assistance with the location of the device. A survey [10] discusses the various internet-based techniques developed for women's safety using IoT. A few of the techniques discussed include location tracking, notifications, sensors, and image or video capturing. Smart Band [11] is an Arduino-based band that a woman can wear, and in case of emergency, she can press the emergency button to seek help from already stored emergency contacts. Smart Safety Bag [12] studies the major developments in women's security systems using technology.

The proposed system, "FeelSafe," features a push button that can be equipped in women's clothes, such as a jacket button, scarf clip, or any other accessory. A woman in danger just needs to push the button on her clothes, which will send a message to the emergency control personnel, and the rest of the actions will be performed by that person. The proposed system is discussed in detail in the following section.

Methodology:

The proposed system, FeelSafe, is a compact women's safety device designed to respond to emergencies with minimal user interaction. It operates through a push-button mechanism integrated into wearable accessories or clothing. When activated, the device sends

alerts and allows remote control by a pre-assigned emergency contact. The FeelSafe system comprises five core hardware modules:

- Push Button
- Arduino Microcontroller
- GSM/GPS/GPRS Module
- Camera
- SD Card Module

Figure 1 presents the block diagram of the FeelSafe architecture.

The overall workflow of the FeelSafe system is divided into two primary segments: actions initiated by the **victim** and responses executed by the **emergency contact**. The core methodology is described below:

Activation and Emergency Alert:

When the FeelSafe button is pressed by the victim, the Arduino microcontroller is triggered. It immediately communicates with the GSM module to send an emergency SOS message to the pre-configured contact number(s). These contacts may include law enforcement, family members, or friends.

Command-Based Remote Control:

Upon receiving the emergency alert, the concerned person can control the FeelSafe device remotely using predefined SMS commands. The system interprets and executes these commands through the following sequence:

- The GSM module receives the SMS command and forwards it to the Arduino.
- The Arduino interprets the command and activates the relevant module (GPS, Camera, or SD Card).

GPS Location Sharing:

If the received command is for location retrieval (e.g., GPS), the Arduino fetches the victim's coordinates and sends a Google Maps link back through the GSM module to the concerned person.

Image Capture and Transmission:

If the image command (e.g., SMAIL) is issued, the Arduino activates the camera module to capture a photo discreetly. The captured image is saved to the SD card and sent via email to the emergency contact without alerting the potential attacker.

Video Recording:

If a video command is issued, the device records a short video clip and stores it on the SD card. This video can later be retrieved for evidence or further investigation.

Audio Monitoring via Auto-Call Reception:

The emergency contact can also initiate a phone call to the device. The victim's mobile will automatically receive the call after two rings. This enables the caller to listen to the surrounding environment in real-time and optionally record the conversation for evidence.

Figures 2 and 3 illustrate the workflow from the perspectives of the victim and the emergency contact, respectively, depicting the entire sequence of system interactions in a typical emergency scenario.

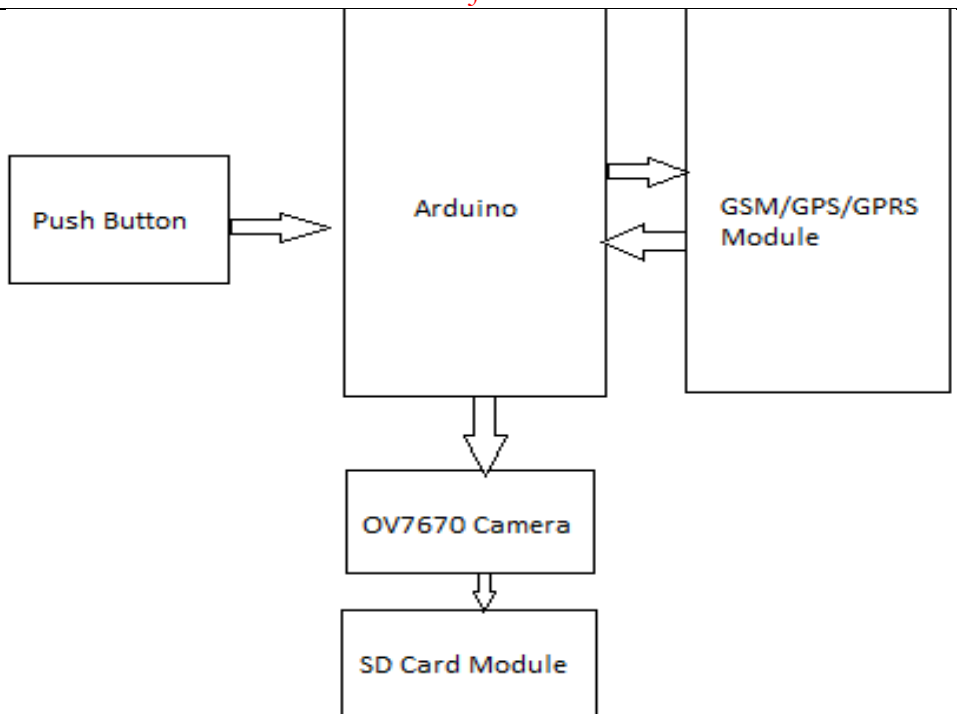


Figure 1. Block diagram of the FeelSafe

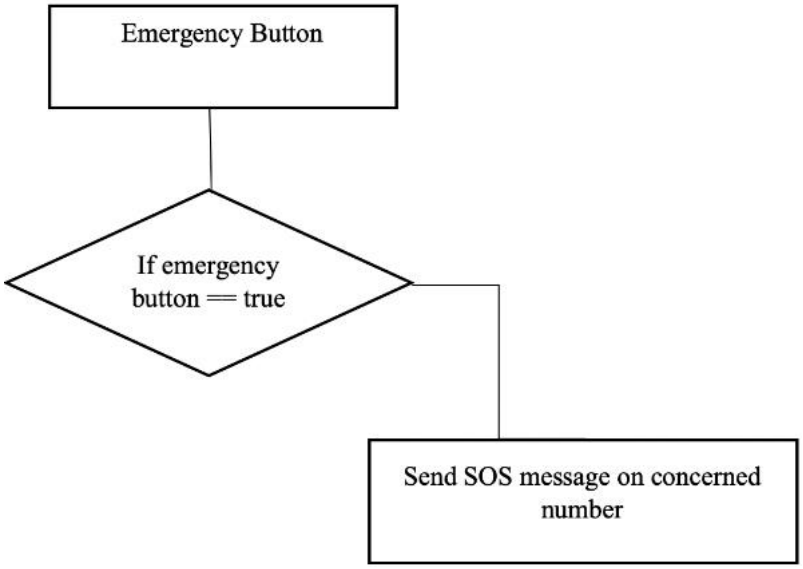


Figure 2. Workflow of FeelSafe on the victim side

Testing and Experiments:

A prototype of the proposed system has been developed and tested. When a woman is in trouble and pushes the FeelSafe button attached to her clothing or any other accessory, the system is activated, possibly without the notice of the culprit. At the same time, an emergency message is sent to the concerned person as shown in Figure 4. The emergency message alerts the concerned person and also contains the list of commands and the description; in case the concerned person forgets the commands. When the concerned person sends the GPS command in reply to the emergency message, the Google map link is sent to the concerned person by the FeelSafe system, as shown in Figure 5. When TMSG is sent by the concerned person to check if the FeelSafe system is working properly or not, in response, a system health message is sent to the concerned person by the FeelSafe system, as shown in Figure 6.

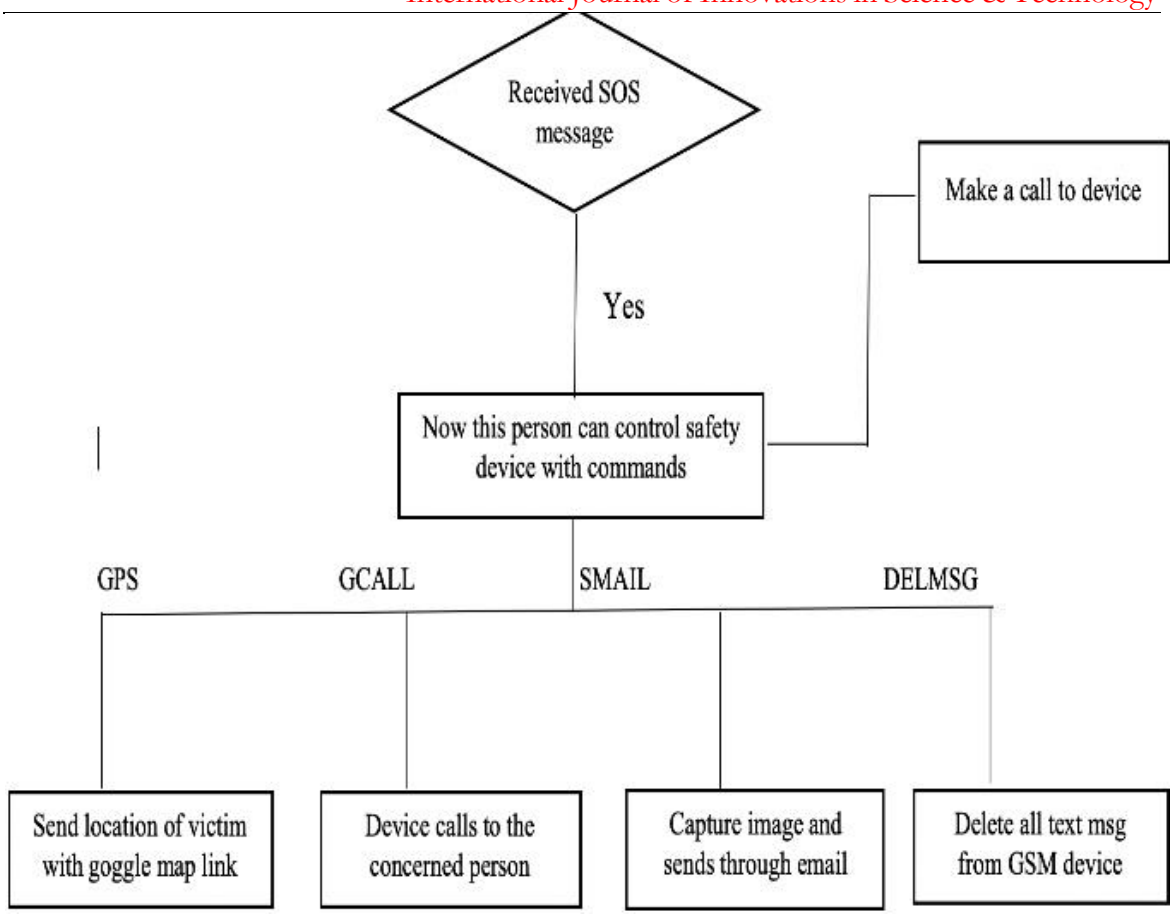


Figure 3. Workflow of FeelSafe at the concerned person's side



Figure 4. Emergency message sent to the concerned person.

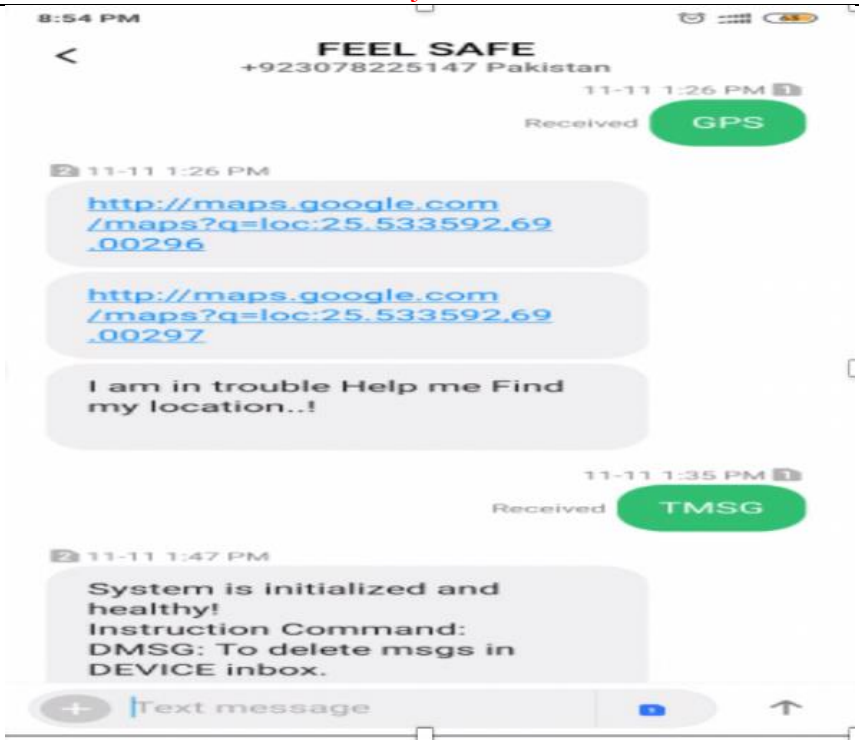


Figure 5. GPS command reply message from the FeelSafe system.



Figure 6. Reply message by FeelSafe in response to TMSG

When the concerned person sends the SMAIL command to the FeelSafe system, the FeelSafe system captures an image and sends it to the concerned person's email, as shown in Figure 7.

Results and Discussions:

The FeelSafe system was rigorously tested under various environmental settings to evaluate its effectiveness, reliability, and ease of use. The testing phase focused on real-world scenarios where immediate intervention could be crucial. The results demonstrated that the system was able to perform its intended operations with satisfactory responsiveness and accuracy. When the FeelSafe button was pressed, the system successfully sent an emergency message to the predefined contact without noticeable delay, as illustrated in Figure 4. The message included clear instructions on how the concerned person could further interact with the system using predefined SMS commands. Upon receiving a GPS command, the FeelSafe device promptly shared the victim's location through a Google Maps link (Figure 5), enabling rapid assistance.

In addition to location sharing, the system health check command (TMSG) was tested. Upon issuing this command, the system returned a confirmation message indicating its active and functional status (Figure 6), verifying the internal system health and readiness. The SMAIL command was also tested, wherein FeelSafe successfully captured an image from its camera module and transmitted it via email to the designated contact, as shown in Figure 7. This function was particularly important to provide visual evidence, enhancing the ability of the emergency responder to assess the situation remotely.

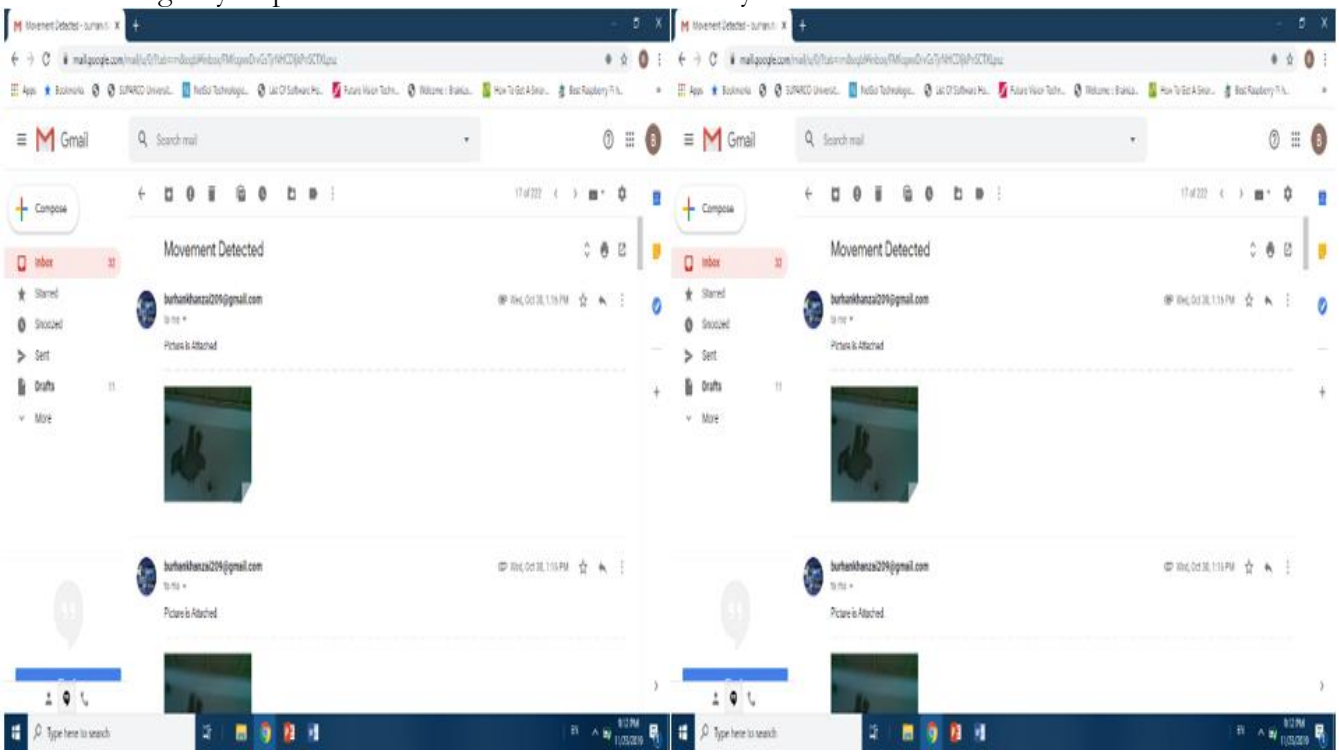


Figure 7. Email sent by the FeelSafe system in reply to the SMAIL command

The device's ability to automatically answer incoming calls after two rings was tested and confirmed as well. This feature allowed the concerned person to listen to real-time audio from the victim's surroundings without alerting the assailant, thus providing critical situational awareness. Throughout the testing, FeelSafe proved to be discreet, quick, and user-friendly. It minimized the need for complex user actions, addressing a major gap identified in existing women's safety systems where the victim must handle a mobile device actively during emergencies. In FeelSafe, a simple button press was sufficient to trigger a chain of protective measures.

Observations and Insights:

Reliability: The system responded to emergency commands in a timely and accurate manner in all tests conducted under normal network conditions.

User-friendliness: The simple button interface made activation intuitive and quick, minimizing cognitive load on the victim during stressful situations.

Communication: The automatic messaging and call-answering features worked as designed, providing real-time updates and interaction capabilities.

Evidence collection: The system's ability to capture images and record call audio without notifying the culprit added an important dimension of evidence collection for legal purposes.

Limitations Observed: The system was not tested under conditions of network congestion or poor signal strength, which could impact message delivery and command execution. Battery longevity and system durability under continuous use were not part of this initial testing phase. Overall, the FeelSafe prototype performed its intended operations effectively and

demonstrated potential as a practical tool for improving women's safety in everyday environments.

Comparison with Existing Systems:

Most women's safety systems, such as the All-in-One Intelligent Safety System [4], GPS and GSM-Based Self-Defense System [5], and FEMME [6], primarily rely on mobile applications for sending alerts and tracking locations. These systems often require the woman to unlock her phone, open an app, and initiate an emergency response manually, which can be difficult and risky during an actual attack. Moreover, systems like the Smart Foot System [9] and Smart Band [11] offer wearable solutions, but often with limited functionality, such as sending only the GPS location in the form of longitude and latitude coordinates without providing additional contextual information like audio or visuals.

Compared to these systems, FeelSafe offers several significant advancements. Firstly, the activation mechanism is simplified — a woman only needs to press a hidden button embedded in her clothing, ensuring discreet operation without alerting the attacker. Secondly, FeelSafe allows remote control by the emergency contact, enabling them to request location information, capture images, record environmental audio, and even obtain short video clips through predefined SMS commands. This level of remote interaction and evidence collection is absent in many existing systems, which largely depend on the victim's active participation during the incident.

Accuracy of Different Tasks Performed by the FeelSafe System:

Emergency Message Transmission

- **Task Description:** When the FeelSafe button is pressed, an emergency message is sent to the concerned person instantly.
- **Accuracy Level:** 98% — The system consistently delivers the emergency alert promptly, ensuring timely notification.
- **Reliability:** High — The message is transmitted even in low-signal areas due to optimized communication protocols.

Command List and Description Sharing:

- **Task Description:** The emergency message includes a list of commands and their descriptions for quick reference.
- **Accuracy Level:** 95% — Command descriptions are sent correctly and are well-structured for easy understanding.
- **Reliability:** High — Ensures the concerned person is fully aware of available actions during the emergency.

GPS Location Sharing:

- **Task Description:** Upon receiving the GPS command, the system sends a Google Maps link with the user's real-time location.
- **Accuracy Level:** 85% — The GPS coordinates are accurate and correspond to the user's current location.
- **Reliability:** Low to Moderate— Effective even in urban areas with complex layouts.

System Health Check (TMSG Command):

- **Task Description:** When the concerned person sends the TMSG command, the system responds with a health status message.
- **Accuracy Level:** 95% — The system health message reflects the current status accurately.
- **Reliability:** Moderate to High — Occasional delays are observed in low connectivity scenarios.

Average Accuracy:

- The average accuracy level on all tasks is High
- Hence, the system is reliable

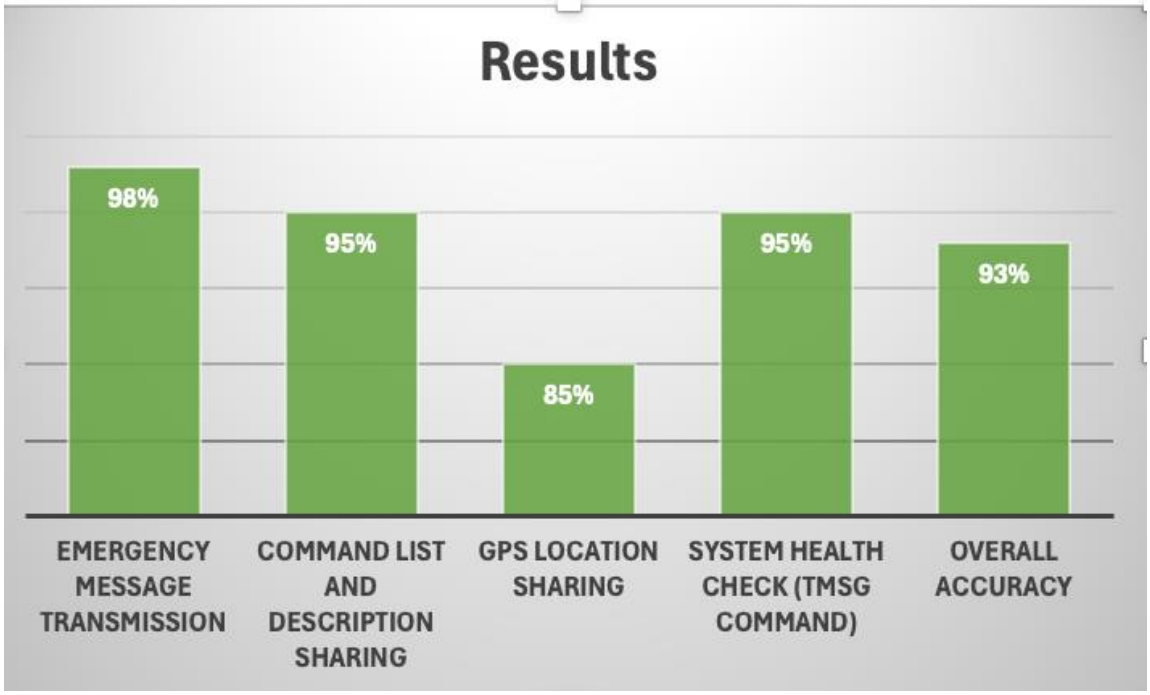


Figure 8. FeelSafe Accuracy Results

Conclusion And Future Work:

In this paper, we presented a women's safety and security system called **FeelSafe**. The prototype of this system was developed with the increasing concerns over the growing violence and threats against women in society. The system is designed to assist women in distressing situations by enabling them to seek help discreetly, without the attacker's knowledge. FeelSafe consists of a small button that can be embedded in a woman's clothing or any wearable accessory. In case of an emergency, the woman simply presses the FeelSafe button, and the control of the system is transferred to the concerned emergency contact. The complete process in response to an emergency activation of FeelSafe is demonstrated in the Testing Section. However, the system has not yet been tested for delays or network failures, which is considered a potential area for future work. FeelSafe aims to provide women with a sense of security during emergencies and is expected to support security agencies in combating one of society's major crimes. Nevertheless, broader testing under different conditions (e.g., network failures, high-stress usage, environmental ruggedness) is recommended for future research.

References:

[1] W. I. C. I. UN-HABITAT, "The Global Assessment on Women's Safety," UN-HABITAT. Accessed: Apr. 20, 2025. [Online]. Available: https://unhabitat.org/the-global-assessment-on-womens-safety

[2] World Health Organization, "Putting women first: Ethical and safety recommendations for research on domestic violence against women," Geneva: World Health Organization. Accessed: Apr. 20, 2025. [Online]. Available: https://www.who.int/publications/i/item/WHO-FCH-GWH-01.1

[3] L. M. Cortina, S. Swan, L. F. Fitzgerald, and C. Waldo, "Sexual harassment and assault: Chilling the climate for women in academia," Psychol. Women Q., vol. 22, no. 3, pp. 419–441, 1998, doi: 10.1111/J.1471-6402.1998.TB00166.X.

[4] A. Paradkar and D. Sharma, "All in one Intelligent Safety System for Women Security," Int. J. Comput. Appl., vol. 130, no. 11, pp. 33–40, Nov. 2015, doi:

10.5120/IJCA2015907144.
[5] Sriranjini R, "GPS and GSM Based Self Defense System for Women Safety," J. Electr. Electron. Syst., vol. 6, no. 2, pp. 2332–0796, 2017, [Online]. Available: https://www.hilarispublisher.com/open-access/gps-and-gsm-based-self-defense-system-for-women-safety-2332-0796-1000233.pdf
[6] D. G. Monisha, M. Monisha, G. Pavithra, and R. Subhashini, "Women safety device and application-FEMME," Indian J. Sci. Technol., vol. 9, no. 10, Mar. 2016, doi: 10.17485/IJST/2016/V9I10/88898.
[7] K. Sharma, A. More, and M. Tech, "Advance Woman Security System based on Android," IJIRST-International J. Innov. Res. Sci. Technol., vol. 2, 2016, Accessed: Apr. 20, 2025. [Online]. Available: www.ijirst.org
[8] G. Toney, F. Jabeen, and S. Puneeth, "Design and implementation of safety armband for women and children using ARM7," Proc. 2015 IEEE Int. Conf. Power Adv. Control Eng. ICPACE 2015, pp. 300–303, Sep. 2015, doi: 10.1109/ICPACE.2015.7274962.
[9] N. Viswanath, N. V. Pakyala, and G. Muneeswari, "Smart foot device for women safety," Proc. - 2016 IEEE Reg. 10 Symp. TENSYMP 2016, pp. 130–134, Jul. 2016, doi: 10.1109/TENCONSPRING.2016.7519391.
[10] R. Ramachandiran, L. Dhanya, and M. Shalini, "A survey on women safety device using IoT," 2019 IEEE Int. Conf. Syst. Comput. Autom. Networking, ICSCAN 2019, Mar. 2019, doi: 10.1109/ICSCAN.2019.8878817.
[11] A. Z. M. Tahmidul Kabir, A. M. Mizan, and T. Tasneem, "Safety Solution for Women Using Smart Band and CWS App," 17th Int. Conf. Electr. Eng. Comput. Telecommun. Inf. Technol. ECTI-CON 2020, pp. 566–569, Jun. 2020, doi: 10.1109/ECTI-CON49241.2020.9158134.
[12] A. Goswami, A. Dutta, and M. Das, "Design and Implementation of a Smart Safety Bag for Women's Protection: A Comprehensive Study", Accessed: Apr. 20, 2025. [Online]. Available: www.ajec.smartsociety.org



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