

# Women's Wearable Security and Safety Device

S.K. Anisha, S.Chandana, J.J.Teresa, S.Varma, M. N. Thippeswamy

**Abstract:** In today's world, one of the major issues that women all across the globe face is threats to their safety and security. This paper presents a quick safety device that responds immediately when women are in danger. The device is equipped with a button and on pressing the button, a "HELP" message is sent along with the location coordinate to the trusted contacts via an SMS. The device is also capable of capturing an image and a video which can then be analyzed to identify the perpetrator. When a woman feels threatened or she finds herself in a compromising situation, she can use this device for her safety.

**Index Terms:** Internet of Things, Raspberry-Pi, Wearable, Women's security

## I. INTRODUCTION

Safety is a crucial power of an individual whether at home or outside. In today's world, women are less safe and secure. They face critical abusive situations such as assaults where their safety is compromised. The government has introduced various laws and opened many agencies to improve the policies. Many devices have been developed to ensure safety and security of women. Many digital applications have been introduced that serve as a means to battle against offenders against women.[1]

The proposed system is a safety mechanism in case of emergencies whenever women are in grave danger. The proposed system can be used as a wearable device that can be worn by women everyday so that they can use it whenever they feel threatened. The main purpose of the system is to alert the trusted contacts through SMS whenever women press a button. The location of the victim is sent via SMS to the trusted contacts so that they are able to track the location of the victim. A GPS Module is used to capture the location of the victim and a GSM module is used to send SMS to the trusted contacts. The system also has a camera that captures the image of the offender and sends it to predefined emails of the trusted contacts. A video is also recorded and sent to the same contacts. The system is mainly designed for women but can also be used by elderly people and children.

The main objective of the system is to provide safety to women from dangerous people. When the victim presses the button, the trusted contacts are notified of the location of the victim and an image is sent so that it can be used for further purposes. An android application called SEGURO is also developed so that the victim can use it to send messages to the trusted contacts when the button is inaccessible. Location information can also be sent via the app by the victim.

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All the information is stored in clouds like Google Drive and Firebase. Both the clouds contain information sent by the module like the images. A study is carried out to review the already existing systems and the salient features are incorporated in the proposed system. In the proposed safety system, the deficiencies of the existing systems are identified and a novel system is developed. The novel contributions are:

- A Women's wearable device is designed using Raspberry Pi, GSM Module, GPS Module and a camera, which can capture images and record a video to provide visual proof whenever the victim is attacked. Based on this information, the perpetrator can be caught and the victim can be located easily.
- A reporting system is developed to store the visual proof and upload it to cloud and send it via mail for further documentation.
- An Android App is developed to obtain the location of the victim. The victim can also send the location to the trusted contacts through the App. A call feature has also been integrated. The App also provides a portal to inform the necessary emergency authorities whenever the victim is threatened.
- A face recognition system is implemented on the recorded video that helps identify the perpetrator in case a face is detected. This enables the emergency authorities to catch the perpetrator easily.

## II. RELATED WORKS

The literature survey is undertaken so as to study similar works which had been carried out in the past. These include papers on devices for monitoring various health parameters, smart phone applications, wearables such as wrist bands, pendants, footwear, etc. and the communication mediums that could be used in case of emergency. After studying these papers, we have adapted the important features of a few devices and we have added some modifications to enhance the already existing system. The information obtained from the literature survey was used as a basis to enhance our safety system. The authors have devised a completely electronic GLOVE with the circuitry mounted within the glove and properly insulated from the outside so as to prevent the user from any kind of harm or danger. The user only has to activate the palm side of the glove which is the conducting layer on encounter of any violent activity. On activation, the conductive layer gives a frightening shock to the attacker as a result of which the oppressor has a profound impact on the muscular activity, thereby, overpowering the wearer over the attacker with ease. The proposed system introduces a technique of a wearable fingerprinting device via machine learning that enables addressing the cyber-attacks, provides cyber threat intelligence and also demonstrates the feasibility of the proposed technique to provide reliable cyber threat intelligence.



## Women's Wearable Security and Safety Device

It focuses on Bluetooth protocol which is a common protocol used by the wearables and other IoT devices. The authors have conducted a detailed survey on commercially available wearable devices ("wearables") and research prototypes. They have classified the wearables, conducted a research on the existing wearables in the market along with drawing comparisons among one another. A partial portable device for the rescue of women was proposed. The authors have tried to create a safety system that merges the benefits of android applications on phone and wearable apparels or ornaments. The prototype developed by the authors uses Arduino Uno board, GPS module, GSM module, Raspberry Pi, and a Webcam. [2-5]

The work mentioned deals with the development of a good robust and high precision platform of wearable devices of internet of things. Based on the boost algorithm to optimize the path and Agent algorithm, the wireless network data transmission is well designed. A wearable device solely used in both monitoring the patients and preventing repetitive ankle sprain due to chronic ankle instability was designed. This device was connected to a smart phone for storage and analysis. The authors have mentioned that the prototype is based on the usage of various sensors to monitor the health conditions of an individual and alert the medical practitioner during any fluctuations in the health parameters. The prototype uses Bluetooth Low Energy (BLE) for communication purposes. BLE is a replacement for Bluetooth as it is more efficient and less power consuming. The system proposed describes the usage of a smart foot device for women to alert friends and relatives during emergency situations. Since a mobile phone may not always come handy for a victim in times of trouble, a smart foot device has been developed. [6-9] The various prototypes

The overall structure of the system is given in Figure 1. The proposed system follows the model given in Figure 2.

developed in the literature survey have provided a basic framework for safety device. Most of the prototypes encountered sent messages containing the location of the victim. Though the prototypes were all developed for the sole purpose of providing safety to women, they are implemented differently, some are implemented as a Foot Device, some are implemented as safety vests and some are implemented as gloves. [2-14]

The proposed device in this work, uses the basic framework mentioned in all prototypes by sending the location to the trusted contacts via SMS. A camera feature is added to the device to capture visual evidence. A face recognition deep learning network is also adapted. An Android app is also developed along with the hardware device.

### III. WORKING OF THE SAFETY DEVICE

The proposed prototype aims to develop a wearable device for ensuring the safety of women. The working of the device is briefly explained :

On the first use of the device, the trusted contacts need to be added in the dedicated android device (Seguro). When the button on the device is pressed the following actions occur:

- GPS module activated; current location of the user captured and sent through SMS message via the GSM module to trusted contacts
- Pi camera activated; image captured and uploaded to Drive; image copy sent to email IDs of trusted contacts
- Pi camera still on activated mode; video recorded and sent to the email IDs of trusted contacts
- Captured image/video analyzed by face recognition algorithm; face identified if matched with the database of criminals

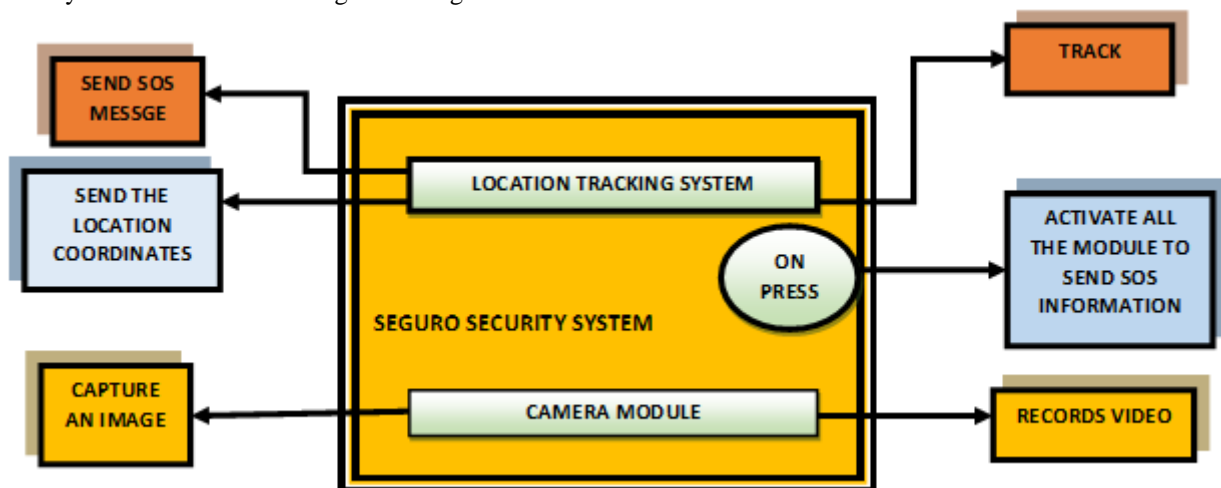


Figure 1: The overall structure of the proposed system.

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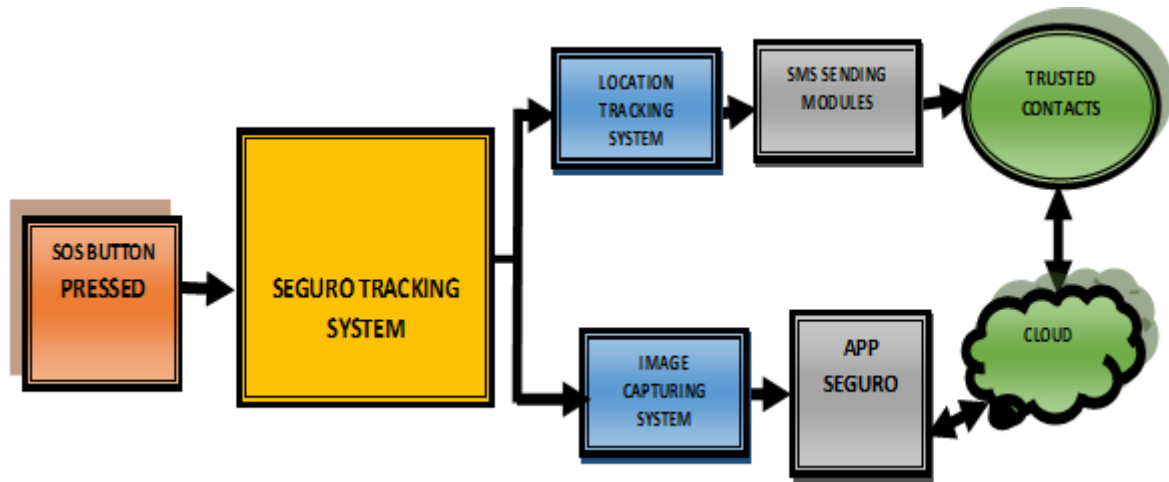


Figure 2 : The Proposed System

**A. WORKING OF THE ANDROID APP-SEGURO**

An Android Application called SEGURO is developed that can be integrated with the safety system. The app has a login module that allows the users to use the app along with the safety device. The app has modules to add, delete, view and modify trusted contacts to whom the SOS message will be sent. There is an option to send the location as coordinates to the trusted contacts. The app also has an option to call the trusted contacts. The app can also be used to view the image that is captured when the user presses the SOS button from drive. Overall, the app functions as a substitute for the safety device and can be used to provide additional safety to the user.

**B. WORKING OF FACE RECOGNITION**

Face recognition is a method used to identify and verify the identity of a person through various features of their face. The image captured using the camera when the user presses the SOS button is analysed to see if any face is detected, if detected the face is recognised and the name is notified to the trusted contacts so that the perpetrator can be caught. OpenCV, numpy, Haar Cascade classifier is used for face recognition.

The whole face recognition algorithm can be classified into the steps given below

- Step 1: An input containing the images of faces is considered.
- Step2: The face is detected.
- Step3: The picture is then transformed for more accurate results so that the image is cropped eliminating the unnecessary background.
- Step 4: The cropped image is then sent to the deep learning algorithm, Facenet.
- Step5: It will output a vector representation of that face.
- Step 6: Then the representation is compared against the already trained faces to determine if any known face can be recognised.

**IV. IMPLEMENTATION**

In this section, the implementation of the wearable security and safety system is briefly discussed. The Table 1 gives all the components used to implement the wearable security and safety system in this work. Figure 3 shows the flowchart for the safety device. Figure 4 shows the flowchart for the Android App. The overall working of the system is explained subsequently.

Table 1: The various components used in the safety device

Hardware Specifications	Software Specifications	
Hardware Requirements	Hardware Requirements	Software Requirements
Raspberry Pi 3	Processor : Intel® Core™ i7-2670 QM @2.20 GHz	Platform : Windows 10, Mac OS
GPS Module	RAM : 4 GB	Mojave, Ubuntu 16.04, Raspbian
GSM Module	HDD : 80 GB	Front End : Python
Pi camera		Back End : Firebase, Android
Buzzer		
Pushbutton		
Power Supply		



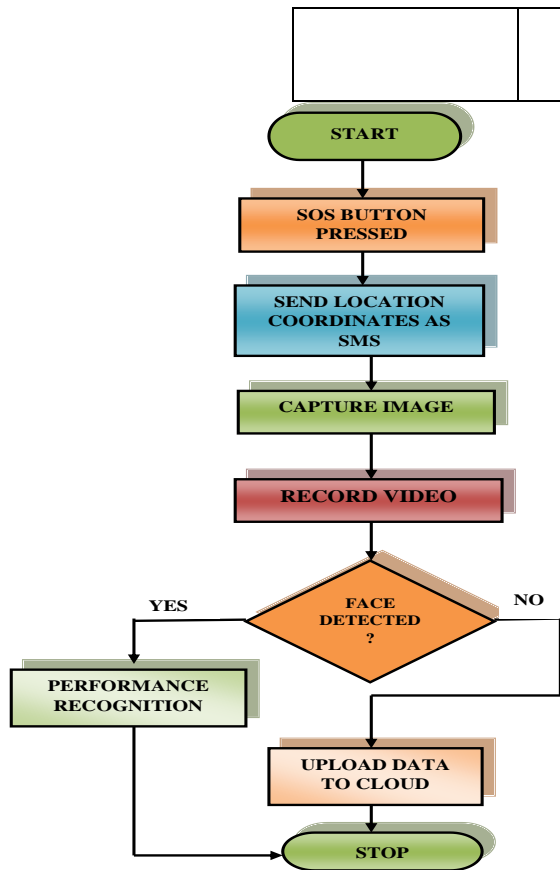


Figure 3: Flowchart for the safety device.

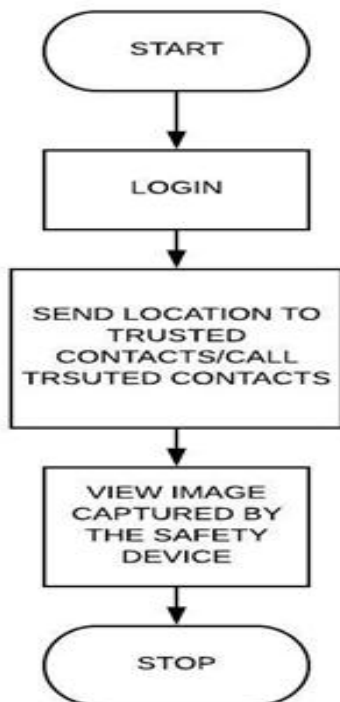


Figure 4: Flowchart for the Android App SEGURO.

V. RESULTS

The design was finalized and the device was assembled as per the protocol defined in the implementation section. The security system was made operational after interfacing with different hardware components and software modules. The results are briefly explained in the following sections.

5.1 GSM and GPS Module Results

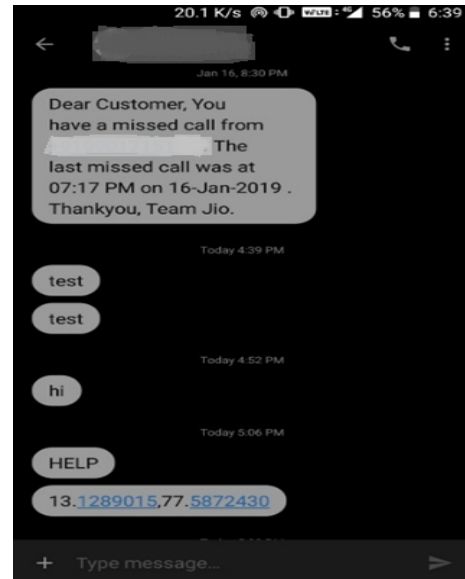


Figure 5: SOS Message



Figure 6: Location on Google Map

When the victim presses the SOS button the GPS module determines the current location of the victim that is sent as an SMS to the trusted contacts (Figure 5). When the coordinates are pasted in Google Maps application, the current location can be determined (Figure 6). A message that says “HELP” is also sent through the GSM module so that trusted contacts get to know that the victim is in danger. (Figure 5)

5.2 Image and Video Output:



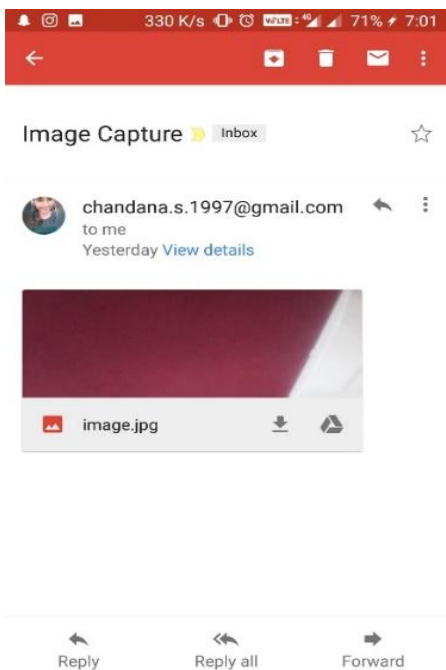


Figure 7:Image sent to Mail

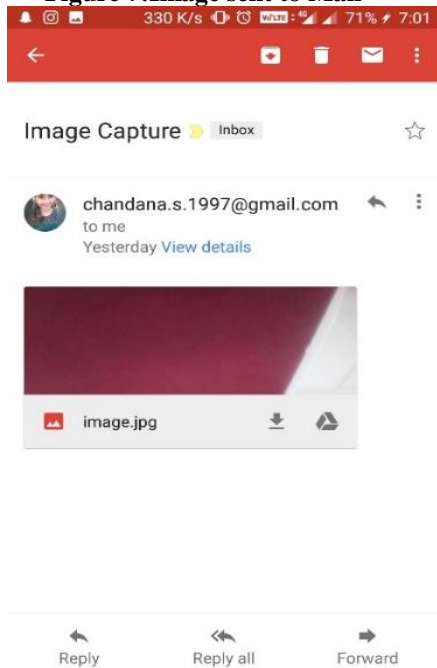


Figure 8:Image uploaded on drive

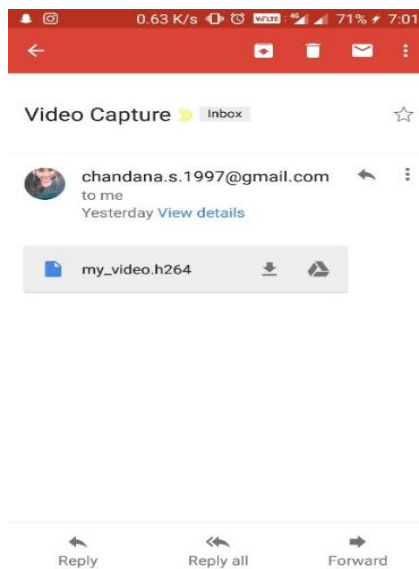


Figure 9:Video sent to Mail .



Figure 10: Location on the App

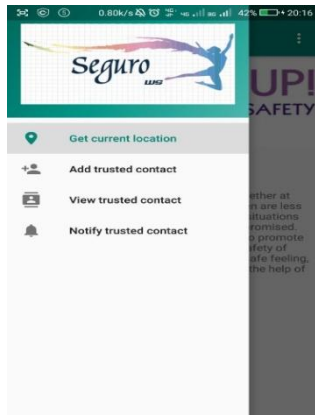
The image captured is sent to Gmail(Figure 7) and it is uploaded on Drive (Figure 8) so that the user can recognize the attacker. The image can be accessed through Drive and viewed through the app. A live video is recorded for ten seconds and it is mailed to the trusted contacts. The video can be viewed using VLC Media Player to recognize any familiar surroundings. The format of the recorded video is h244.(Figure 9)

5.3 SEGURO output



Figure 11: About the App





**Figure 12: App functions**

The App provides various features like displaying current location (Figure 10), sending current location to trusted contacts, add or view trusted contacts, call trusted contacts. It can also be used to view the image that is captured by the safety device. (Figure 11 and 12).

### VI. CONCLUSION

The primary focus of the work is to ensure women's safety when the situation calls for it. With this thought in mind, the device is modelled and developed, providing accurate data which would help the women in times of need. Equipped with GPS module, GSM module and Camera, the location, image and video data are stored, sent to the trusted contacts and analyzed for further action. The device can be prototyped into various sizes ranging from a pendant to wearable vest.

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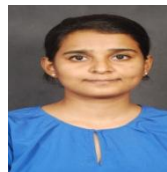
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### AUTHOR'S PROFILES



**Anisha Sajit Kamat** is currently employed at WIPRO as a project engineer. She pursued her bachelor's in computer science and Engineering at NITte Meenakshi Institute of Technology. Her first project at WIPRO involved statistical analysis of enormous amounts of customer data of Oriental Bank of Commerce (client) using SAS Business Intelligence tools. Presently, she's working with Punjab National Bank on a project that involves creating a strong foundation framework that enables the analysis of various business domains across the bank. Her work primarily focuses on analyzing and developing reports for client through SAP Business Objects, thereby assisting the bank in decision making and analysis.



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**J Jubila Teresa** is currently working as a Software Development Engineer at McAfee Software India. She pursued her Bachelors at NITte Meenakshi Institute of Technology, Bengaluru and majored in Computer Science and Engineering. She is passionate about solving problems and has shown her interest in the field of cyber security. She is currently working on design and development of software with an understanding of the existing system. She has developed internal tools for the company. Prior to this, she has worked for Wipro Limited as a Project Engineer where she used ETL tools such as DataStage and Informatica to design and enhance jobs to load daily sales data for the client. She is capable of adapting to new technologies and is fond of taking up new challenges.





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