# Chapter 27
# Women Safety Device with Real-Time Monitoring


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**Abstract** In every way, the world is becoming less safe for women. Because of the rise in crime, women feel unprotected. According to WHO estimates, one in every three women in the world has experienced physical or non-physical violence at some point in their lives. This paper proposes a quick responding mechanism that helps women during trouble, specifically in a public toilet and house or public parking. This work aims to develop a wearable device for the safety monitoring system for women. The device consumes less power and is created on an open-source single-chip ATmega328 microcontroller with 8-bit reduced instruction set computer RISC processor core based on Harvard architecture. The coding software is written in Java and can be run on Windows, Mac OS X, and Linux. A smart device for women's safety is proposed in this paper, which automates the emergency alert system by using a motion-detectors sensor and a body temperature sensor to detect a potential incident instantly using a detection algorithm. This device detects and sends alerts to close friends and families with the women's location coordinates without requesting communication in crucial circumstances.

**Keywords** Woman security · Monitoring device · IoT · GSM · GPS

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## 27.1 Introduction

Women's safety can be a major concern in countries such as Malaysia, where women play a striking position in each sector. Malaysia-Asia may be a country caring for peace and one among other healthy tourist destinations across the world. But a few recent history incidents have proven that there is a need for security for ladies. Nowadays, in this technology and modern world, women are exposed to danger. The safety of women is in trouble. Danger might happen anywhere, even at public toilets and house parking. These days, violence against women remains a widespread problem. It is very sad and scary to read and hear news about violence against women. The rate of crimes against women is not decreasing but increasing at an alarming rate, especially harassment, molestation, eve teasing, rape, and kidnapping. Sexual violence against women greatly increases.

This becomes a serious issue as our country lacks adequate laws and enforcement of existing laws. The situation will affect a women's life until the end of her life. Women will be traumatized. In addition, no safety mechanisms are available to protect girls from misbehavior activities. No alert mechanisms for girl's safety; it should be done manually only. For example, before going out, we call husband or parent to inform them but they do not know what will happen to her on her way to the place. The women working feel insecure because of rising crimes. The government has taken several preventive steps to avoid these misbehaving practices but has still not affected the through rate of these crimes and barely changed.

This project's goal was to generate a security system that can systematically monitor women. The coding software is written in Java and can be run on Windows, Mac OS X, and Linux. The location will be sent to the preset contacts in a single click. If the device detects any movement, the global system for mobile (GSM) communications also will be sent message links to preset contacts in terms of latitude and longitude coordinates in google maps, which will be sent from a device to the preset contacts in a single click, whereas in PIR sensor can detect the presence of human by detecting movement.

Our main objective was to improvise a safety monitoring system for women's security. Other than that, it is to detect using current locations by using the global positioning system (GPS) tracker. The second objective is to share the current location of the user with preset contacts using GSM. Finally, our last objective is to detect human presence by detecting body temperature using a passive infrared sensor (PIR). The main scope of this project is to monitor for women's security. It also includes sharing current locations and detects the presence of a human. The objective must be fulfilled so, and there are several scopes outlined.

i. For women, 18 years and above.
ii. Target for students.
iii. Independent women working until late at night.
iv. Alone women.

This project is divided into two main parts: hardware part and software. The outline of this paper is organized as follows. The analysis of the previous related

studies that motivated this work is discussed in Sect. 27.2. Section 27.3 explains the methodology used in the development of this device. Results are described and analyzed in Sect. 27.4. Finally, conclusions are drawn in Sect. 27.5.

## 27.2 Analysis of the Previous Works

According to the previous studies, numerous functions and characteristics evolve in response to technological advancements in women's safety systems [1–5]. In [6], the designed Firebase is a mobile phone app that integrates all the features of existing apps. The app requires initial registration with a login id and password along with emergency contacts. Each contact can be manually added or added from the inbuilt contacts application. Users are registered with the Firebase database to keep the app secure. The app allows users to track their emergency contact via dynamic GPS tracking. The user can also call the toll-free helpline numbers with the inbuilt phone application. When in distress, the user needs to press the SOS button then an alert message is sent to the emergency contacts.

The research in [7] looked at the relationship between stress and skin resistance, stress, and body temperature. Findings suggest that sitting, standing, sleeping, and struggling could be linked to stress levels in the human body. Punjabi et al. in [8] have designed a portable device that has a pressure switch. A pressure sensor can detect when an assailant is about to attack a person. When the person senses any insecurity from a stranger, they can put pressure on the device by squeezing or compressing it. It then senses if the attacker is going to attack them.

However, the device and system that deal with detecting emotional stress levels to predict danger and body position exist today but they do so separately. In this work, a women safety device with real-time monitoring is designed and does not need manual effort where it can detect the user using current locations by using GPS and share the current location user with preset contacts using GSM in a single click.

## 27.3 Methodology

This proposed device is a smart device for women and children's safety that automates the emergency alert system by using a motion sensor and a body temperature sensor to detect a potential incident instantly using a detection algorithm. Without requesting communication in critical circumstances, this device detects and sends alerts to friends and families with the women's location coordinates. The hardware and software are the two main components of this system development. The GPS (GYGPS6MV2), PIR sensors, GSM (SIM900), and Arduino Nano are the six main components of the hardware system.

Other features such as a push button and a phone will be used as the controller's inputs and outputs. The hardware system can be installed in any location where users are present.

GSM and sensors are the most important hardware components in this design for software implementation. This device uses less power because it is based on an open-source single-chip ATmega328 microcontroller with an 8-bit reduced instruction set computer RISC processor core based on Harvard architecture. The coding software is written in Java and can be run on Windows, Mac OS X, and Linux. The GPS keeps track of the user's location and sends it to the GSM network. The data are sent via GSM to pre-determined contacts using the C programming language. The schematic diagram and layout design for the project are created with Proteus. The project's layout is created by manually routing the connections of each electronic component involved in the system's development. Users can be used to replace the entire system. In general, both can act independently as well as in a pre-determined order.

The complete block diagram of a safety monitoring system for women's security is shown in Fig. 27.1. GPS (GYGPS6MV2) keeps track of the current location and sends data to the GSM phone (SIM900). The GSM (SIM900) sends a message to pre-set contacts with the current location. After the data have been received, it will be displayed on the user's phone screen. The PIR sensor is used to detect changes in body temperature, even in dark areas. Within 10 m of a PIR sensor, a human can be detected moving. The precise detection limit is 5–12 m. PIRs are mainly made up of a pyroelectric sensor that can detect infrared radiation levels. Figure 27.2 shows the complete schematic diagram of this project where Fig. 27.3 illustrates the complete flowchart of the safety monitoring system for women's security. Proteus is used to draw the schematic diagram and design the layout for the project. The working layout

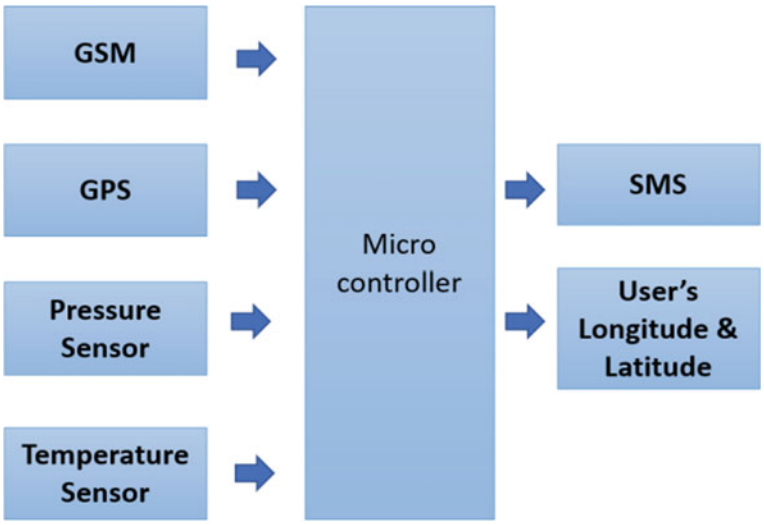


**Fig. 27.1** The overall block diagram of the project

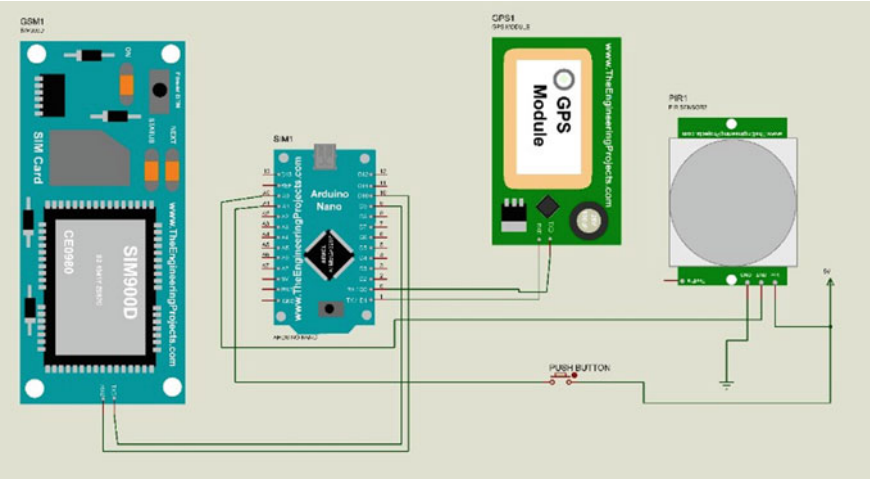


**Fig. 27.2** The complete schematic diagram of the project

is created by using manual routing of the connections of each electronic component involved in developing the system.

## 27.4 Results and Discussion

Figure 27.4 depicts how all of the components used in this project are connected. The red light for the microcontroller board, GPS, and GSM blink when the power supply is turned on. As a result, the components appear to be in good working order. If the GPS red light is not blinking when the project is connected to the power supply, this GPS has not received any signal from the satellite. The GPS's ability to function properly can be affected by a variety of factors. One of the reasons is the user's location.

This project has been tested at three different places. Three other locations have been used to test this work. The first is in an open space area, where the GPS receives satellite signals and can track the user's location. GSM will then send SMS to pre-defined contacts where the message includes a link to the user's current longitude and latitude coordinates. This project was tested again at level 2 of the UniKL BMI building. According to the findings, the GPS received signals from satellites and tracked the user's location. The SMS is then sent to pre-defined contacts by GSM. A link to the user's current longitude and latitude coordinates is included in the message.

On the other hand, the GPS did not blink during the level 10 Residential Bayu Andaman test. The GSM sent SMS to pre-programmed contacts when the push button was pressed, but the latitude and longitude were set to "0, 0." As a result, the user's

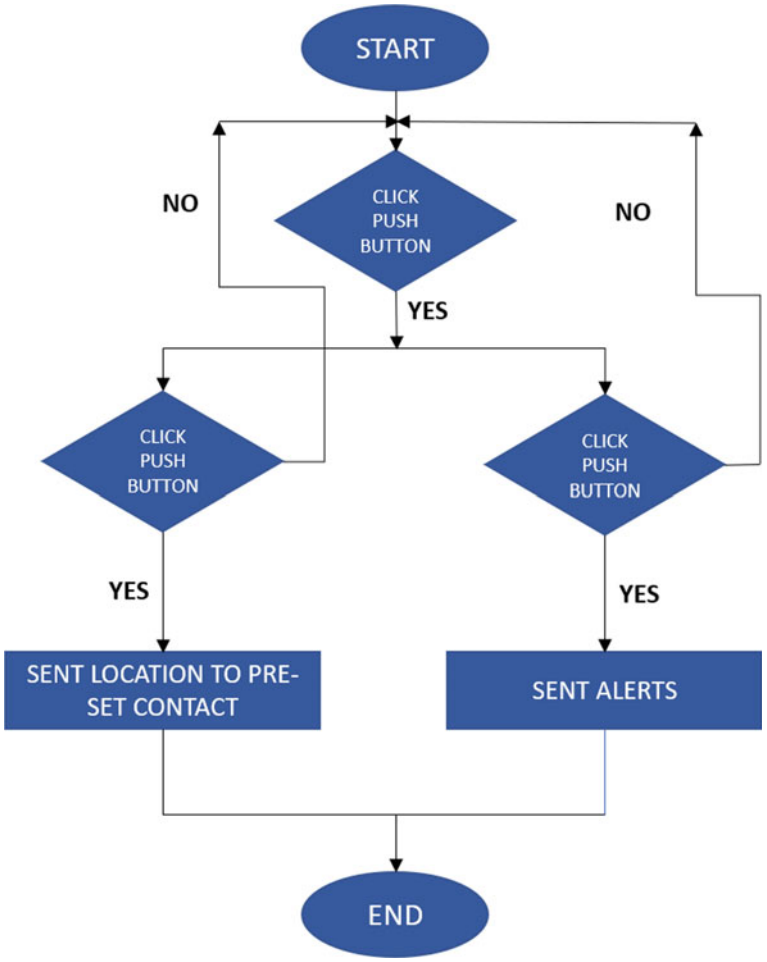


**Fig. 27.3** Block diagram of the proposed system

location is hidden from the pre-set contacts. The above scenario demonstrates that the GPS did not work well in the higher elevations. The strong structure of a building's walls, as well as the weather, has an impact. Under condition two, when the project is powered up, the GPS red light blinks, and the GSM red light blinks fast every 0.5 s, indicating that the GPS receives satellite signals, but the GSM cannot read the GPS prepaid sim card. As a result, GSM did not send any SMS to the pre-defined contacts. Before using this project, it must be connected to a power source. Under condition three, the GPS red light blinks when the project is connected to the power supply. The GSM red light flashes a little slower than condition 2, every 3 s, indicating that the GPS has received satellite signals GSM can read the prepaid sim card. As a result,

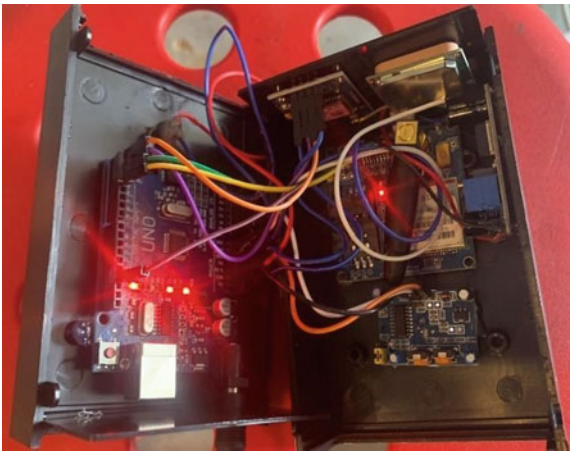

**Fig. 27.4** Prototype

after pressing the push button, pre-set contacts receive SMS from GSM. The time it takes for pre-set contacts to receive SMS is usually between 3 and 8 s.

Few factors, such as location issues, pre-set contact's mobile device issues, different networks used, and network traffic, can cause a delay after the project has been tested. Firstly, the sender's or recipient's location may cause a delay in text message delivery. There is a lag in transmission when all messages come at once on a mobile phone. It can be caused by moving at speeds above about 50 km/h on the border of two cell coverage areas. There are common reasons for this, including tall buildings and old houses with bad reception. Text message transmission can be delayed due to issues with mobile devices. The most obvious cause is a device turned off, but a weak or uncharged battery can also affect message delivery.

Moreover, due to network coordination or the carrier prioritizing their traffic, a text sender and receiver on separate networks may be more likely to experience texting delays than those on the same network. Finally, sending a text during peak network usage has an impact on text delivery speed. During peak traffic periods, the local network may become congested, delaying messages to mobile phones. Figure 27.5 shows the output at the receiver's phone screen. Suppose, the PIR detects any movement and GPS received a signal from the satellite. In that case, it will send a message to the receiver consisting of the user's locations in terms of longitude and latitude. In Fig. 27.6, the user's direction at the receiver's phone screen after clicking the link in the message is direct to google maps, as shown. Figure 27.7 shows the output at the receiver's phone screen. If GPS did not receive any signal from the satellite, but the GSM has functioned well, it will send a message to the receiver but consists of a "0, 0" coordinate for longitude and latitude.

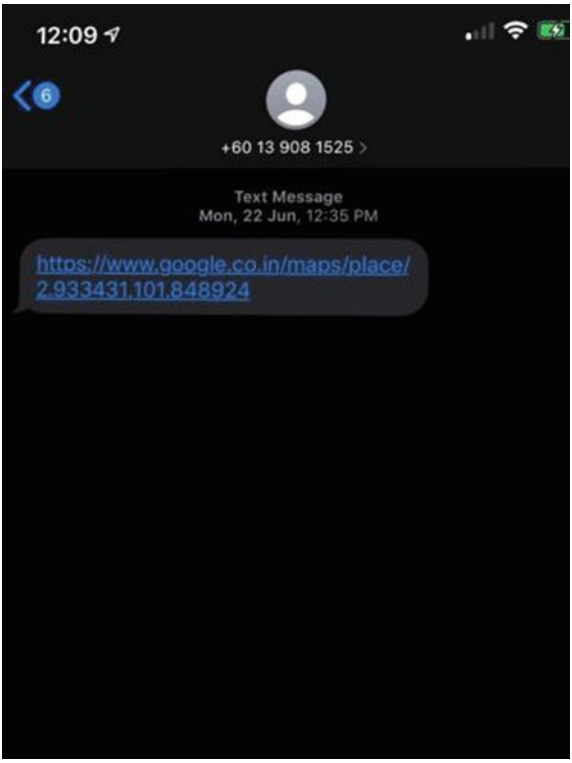


**Fig. 27.5** Output 1 where the user sends a message

## 27.5 Conclusion

We proposed a fast-responding device that helps women during trouble, specifically in a public toilet and house parking. Using less power and based on an open-source single-chip ATmega328 microcontroller with 8-bit reduced instruction set computer RISC processor core based on Harvard architecture, this work aims to develop a wearable device for safety monitoring systems for women and children. This device identifies the situation and sends alerts to friends and families with the women's location coordinates without involving her ability to interact in critical situations. It immediately sends an alert notification to relatives and the nearest police station. The device is designed to be carried in any type of bag, including handbags and laptop bags. This work can be altered to small wearable devices and attach to an alarm system through customization development. An alarm or buzzer is good since it can alert nearby people if anything happens to the user. This device can play a big role in ensuring a safe and secure environment for women.


**Fig. 27.6** Location of the user via GPS

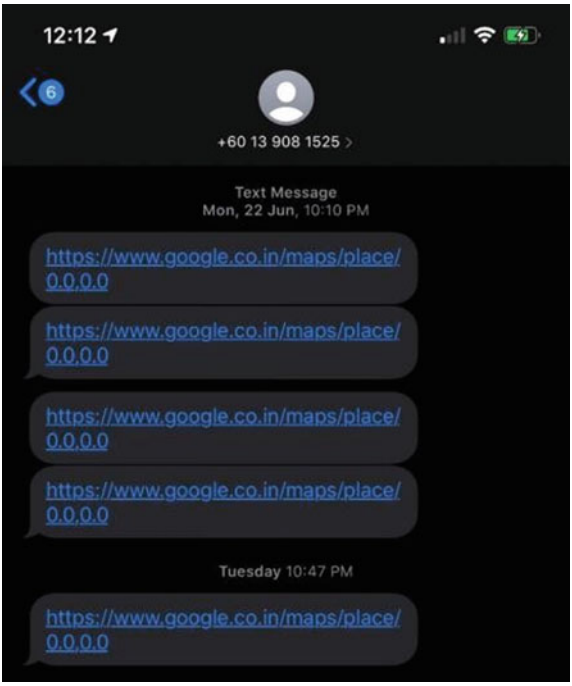


**Fig. 27.7** Message sent to the user with location via GSM

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