Smart Women Safety Device

S. Dilip Kumar, A. Archana, S. Sri Dharshini, and K. Peridev

Abstract Women safety is one of the important issues of our society. The number of incidents such as harassment, molestation, acid attack, etc., is increasing every day. Thus, it is necessary to find a solution for this menace. Many devices and application are in market though they have their own shortcomings. Most of these devices use various physiological signals to find the state of emergency. During stressed times, while running, climbing steps, these devices find fault alert and send alert messages. This could be fixed using a threshold value of individual activity for these physiological activities that reduces the fault alert. The data obtained from these sensors are analysed and processed in microcontroller. If the values obtained are above the threshold, an alert message is sent along with the victim location. This would help to overcome the drawbacks of current devices.

Keywords IOT · Women safety device · Physiological signals · MATLAB

1 Introduction

We are committed respecting and protecting women's right, which includes the right to safety of women and girls. Women have the right to be free from violence and harassment. Removing these barriers of the unsafe environment can help women fulfil their potential as individuals. There are number of devices available in market whose main objective is women safety, where they need manual activity such as pressing button in device or in mobile application. Most of these devices follow the same concept. In the existing device, when the button is pressed, it then triggers the controller to alert the GPS module to track the victim's location and with the help of GSM module, the alert message is communicated to the one or many trusted persons. Mental state of women may vary so that the chance of pressing button becomes difficult. To overcome this drawback, an automatic safety device that senses various physiological signals such as heart beat, temperature, stress factor, etc., are used.

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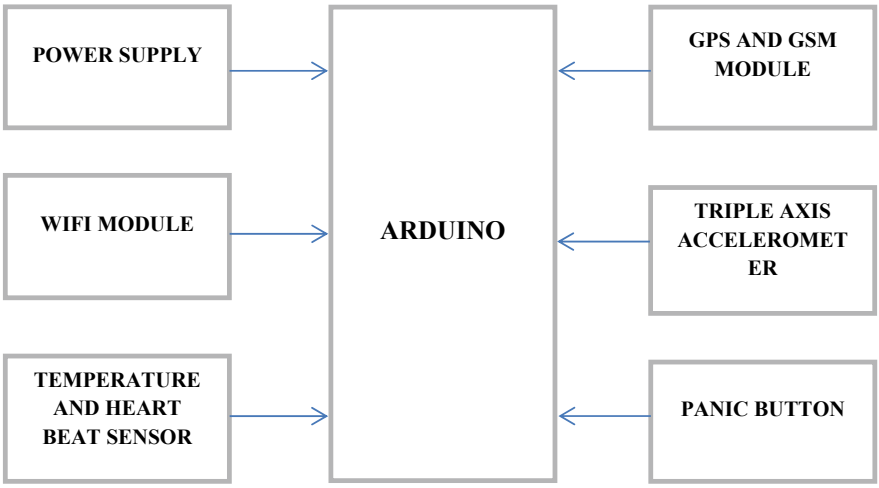
The sensors embedded in the device are heart rate sensor and temperature sensor where it senses the abnormality, if detected, it is then transferred to the cloud. In the existing device, biaxial accelerometer was used to analyse the activities of an individual. To improve its efficiency, triaxial accelerometer is used. The raw data is processed and send to the MATLAB machine learning tool kit (Weka) for the analysis of an individual's threshold range for various activities. The threshold range is further transferred to the Arduino that sends an alert message along with victim's location to their trusted people when obtained signal is above threshold range. The victim's location includes latitude and longitude at different times. The technology used here is the Internet of things which refers to the concept of extending Internet connectivity. IOT devices can collect data, process it locally, and send the data through servers or cloud-based storage to other devices.

2 Block Diagram



3 Existing Methods

A three-way safety module that provides self-defence, evidence recording, and tracking information [1]. This device uses Raspberry Pi 3 b + in accordance with a relay module and a nerve simulator. When the button is pressed, it produces shock to the attacker through the nerve simulator and also rings the buzzer to alert the surroundings. It also consists of a GSM and GPS module that trigger mobile application with a voice command. When the victim feels an unsafe environment, the user has to say word "emergency" and the device sends an alert message to the trusted people along with the location. Additional advantage of using Raspberry Pi is that

it allows audio and video recording. The recorded evidence is sent through GSM module.

SMARISA is a wearable device, a Raspberry-pi nano board, buzzer, button and a camera module [2]. When the person feels unsafe, button is pressed; it activates the microcontroller that notifies the victims trusted people along with the location. The device is embedded as a wearable ring that is interfaced with a mobile application. Captured image is send as a link to the list of contacts that is selected by the victim. Once the button is pressed, high frequency alarm is generated to notify the surroundings for help.

ABHAYA uses mobile application and it can be activated by a single click. When a woman feels insecure, opens the app which sends the location through GPS and the message is sent as an URL to the contacts registered in case of emergency [3]. The message is sent to the person every five minutes until stop button is pressed.

This smart device is attached to the footwear of the person [4]. It consists of Bluetooth module (LBM313), accelerometer (BMA250), and microcontroller (ATMega328P). Light blue bean Arduino microcontroller is embedded with tri-axial acceleration sensor. The victim's mobile Bluetooth and the device Bluetooth are connected. BMA250 is a digital sensor which measures acceleration in three ways such as: tilt, tap, and motion. When it is continuously tapped four times, alert message is sent to the registered contacts via Bluetooth connection to the user smartphone.

Safelet—A wearable women safety device [5]. It is a bracele-shaped safety device that has buttons on the either side. It is in sync with the user mobile to record audio. Whenever the buttons are pressed, it sends message to the contacts selected by the user and the audio recorded with it.

Revolar—Keychain-shaped safety device [6]. When the device is pressed once, the device is activated and sends a message as I'm safe; when pressed twice, it sends yellow alert with a message Ring me along with which the location is also send through revolar mobile application. When it is pressed thrice or even more, it sends red alert indicating more serious help.

A smart wrist band that is integrated with smart phone using Bluetooth low energy (BLE) [7]. The wrist band measures various body parameters such as temperature, heartbeat, and body motion using sensors. When the value of sensors is above normal, it is indicated to the smart phone which sends message to the concern person along with the location coordinates. Latitude and longitude of the victim are converted as Google URL and sent along with the message to the list of trusted contacts in addition with the nearby police station.

An android application that sends alert message when the smart phone is shaken above the threshold value [8]. It does not uses any sensors that are attached to the body, rather uses the inbuilt sensor present in smart phone such as proximity, gravity, etc. The daily schedule of the victim has to be updated in the mobile application previously, if any deviation is identified, a alert message is sent to their parents, friends, or relatives. The GPS and GSM module present in mobile phone track the location and send emergency SMS.

Touch me not—A women safety device that is similar to a button attached to the clothes [9]. It has a hidden spy camera, an alarm, GPS and GSM module, and a

button. When the button is pressed once, an alert message is send to the emergency contacts along with the location of victim. When the button is pressed twice, it creates an alarm so that people nearby would surround for help and the spy camera starts recording the image of the opponent so that it helps as an evidence. The recorded video is stored in a SD card and can be transmitted.

A smart band that has vibration sensor, a buzzer, LCD, along with a GPS and GSM module [10]. When the power is switched ON and the button is pressed, an alert message is send. It checks for the value of vibration sensor if no output is detected, it gets the last location of the victim and sends message else the location of the victim is updated in the webpage using IOT. Also a neuro simulator is present in the wrist band so that it produces a shock of about 1200 mV that helps to escape from the opponent for a fraction of second.

4 Hardware Specifications

4.1 Arduino UNO

The Arduino Uno, open-source board is based on the Atmega328 microcontroller. It consists of the 20 digital input/output pins, 16 MHz resonator, and a power reset button. It can be powered by simply connecting it to the computer with USB cable or with an AC-DC adapter or a battery. The voltage regulator used here is to control the voltage given to the arduino and stables the DC voltage.

4.2 GPS Module

The global positioning system is a network consists of 30 satellites orbiting the earth. The module is used to locating, positioning, and tracking using the maps. It does not require user to transfer data where it operates itself by analysing the location of the user in the telephone or with the Internet facility through the GPS positioning module. The GPS receiver receives a time signal where it calculates the distance between the satellite and receiver. The calculated location tells the position of the data generated.

4.3 GSM Module

The global system for mobile communication is a standard chip or a circuit used as a communication medium between a mobile and a computer. GSM sends data

through channel with two different streams with particular time slot. It consists of a transceiver to transfer messages along with a SIM slot.

4.4 Heart Beat Sensor

Heartbeat sensor measures the heart rate of individual while performing various activities. A plug-and-play heart-rate sensor is used so that it is compatible with arduino. It consists of a simple heart rate sensor with signal amplification and noise cancellation.

4.5 Temperature Sensor

Temperature sensor collects data in form of heat and converts it to the appropriate form for the device. Temperature is sensed through direct contact with heating source or indirectly through radiation. These are sensor ICs that can operate in the range − 55–150 °C.

4.6 Triple Axis Accelerometer

Accelerometers are electromechanical device that senses both static and dynamic forces of acceleration such as gravity, vibrations, and movements. It contains capacitive plates so that change in capacitance measures acceleration. It has low noise and power consumption with a range of ±3 g.

5 Software Specifications

Machine learning is a category of artificial intelligence which implements the system to learn the data without accurate programs. WEKA is an open-source software and compilation of various machine learning algorithm for data mining tasks that is the study of various possibilities of data and gathers useful information and converts it to the human language. The data algorithms can be applied using Java code. It consists of different tools like clustering, regression, data preprocessing, and classification.

6 Methodology

The women safety device is designed as an alerting device. This device consists of Raspberry Pi which is triggered by a panic button. Once the button is pressed, the GPS tracks the location and sends the latitude and longitude of the location to the victim's registered mobile phone through GSM module. When the button is pressed, it generates a high frequency alarm in order to seek the attention from surroundings. It also senses the temperature, heartbeat, and movements of the victim so that even if there is no chance of pressing out panic button, it automatically sends alert message to the contacts.

Workflow of the proposed system

Step 1: Start
Step 2: Switch ON power supply
Step 3: Switch ON the panic button
Step 4: Track location of victim using GPS and send message through GSM module
Step 5: If button pressed twice, create buzzer sound
Step 6: Check threshold values of heartbeat, temperature, and accelerometer sensors
Step 7: If they are above the calculated threshold, send emergency message.

7 Results and Discussion

When the button is pressed by the user, it triggers the microcontroller which sends the command to GPS to find the location of the user. The GSM module sends an alert message with location which includes latitude and longitude to the registered contacts. When the button is pressed, alarm is generated to gather attention from the people in case of emergency (Figs. 1 and 2).

8 Conclusion

This device helps the user to avoid fault alerts by fixing specific threshold values. It is made as a hand held device so that it is easy to carry and compact. Weka toolkit used here for analysing various activities of the user by fixing threshold for each activity. This helps to overcome the drawbacks of other wearable women safety devices.

9 Future Scope

It includes adding up additional features such as sound recorder, camera, and fingerprint module. Audio and video recording helps us evidence so that it could be attached

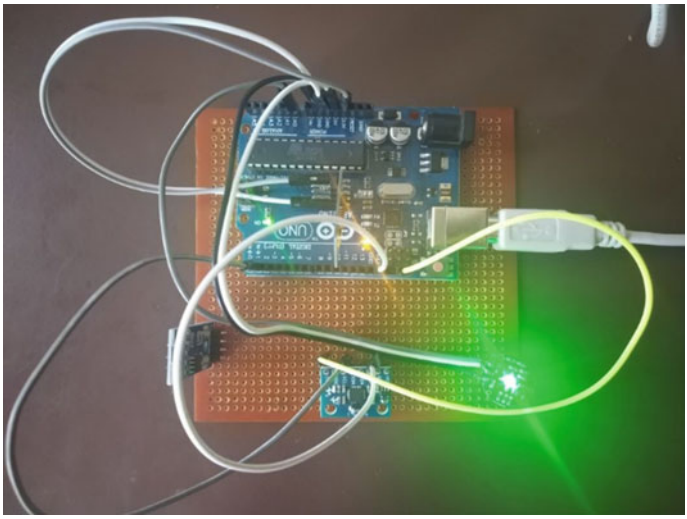
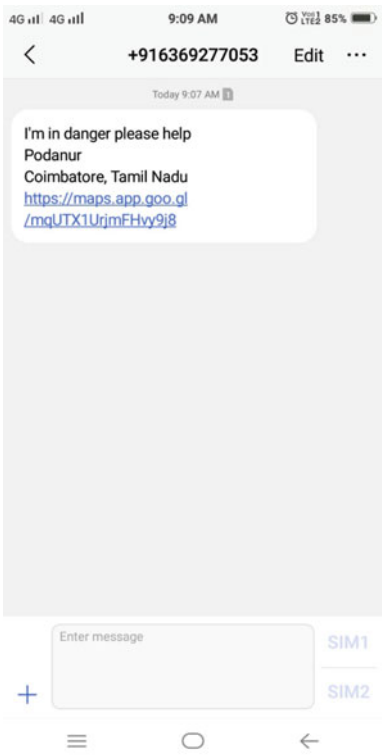


Fig. 1 Hardware setup

Fig. 2 Alert message



along with the location and sent as a message. Fingerprint provides an electric shock for few seconds to the opponent only if it is authorised and provides insulation for the victim. This helps the victim to relax for a second and think wisely to be safe.

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