Chapter 67
JDMaN: Just Defeat Misery at Nagging—A Smart Application for Women Protection

N. Jayanthi, N. M. Deepika, G. Nishwitha, and K. Mayuri

Abstract Women are exploring themselves in various areas in this world and yet are facing many challenges and threats in their daily life; according to the National Crime Records Bureau (NCRB) 93.3% outrage, victims are solo women travelers. Due to these enormity situations, there is an urgent need to develop a women security device that can be easily carried. In this technological age, one gadget which has become like oxygen to everyone is a mobile phone. In such a scenario, by making use of mobile phone, we focus on developing a mobile app along with a wearable smart pendant developed by using IoT that assures women to travel confidently and safely. This IoT-based pendent can work automatically and manually. The pendant is an integration of multiple sensors that can work with or without contact with the human body. To the best of our knowledge, no mobile application or IoT device has proposed prior safety information about the route the user has to travel. Unlike the other mobile applications or IoT devices that will get activated at the time of the incident and then share the location details, our proposed method provides prior information of multiple routes from source to destination indicating safe and unsafe routes, and also a vibration is been given to the user so that she shall not become unconscious if at all she faces any unusual incident. The combination of mobile app and IoT-based pendant works very well in providing safety for women.

Keywords IoT · Wearable device · Mobile application · Safe route · Unsafe route

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67.1 Introduction

In today's world, there is a lot of advancement in technology. But women are still facing unfortunate incidents. As the rate of crimes against women increasing day by day, both young and elderly women are not confident in building their careers even in metropolitan cities like Delhi, Mumbai, and Hyderabad. According to the National Crime Records Bureau (NCRB), 93.3% [21] of outrage victims were solo women travelers. By observing the recent incidents, traveling in a safe route to reach the destination can reduce the risk of unusual incidents.

The sophisticated technologies of twenty-first century have given solutions to the existing problem. One such technology is the Internet of Things which extends the power of the Internet beyond computers and Smartphone with good processing [22]. It is a huge network connected to things and people by which data can be collected, sent, and received about the environment around them [23]. It is a network of physical objects that are nested with software, sensors, and other technologies. Features that made it so popular and powerful are access to the low-cost and low-power sensor, connectivity, cloud computing platforms, machine learning and analytics, and conversational Artificial Intelligence (AI) [24].

In this paper, a Smartphone application and an IoT device are proposed. The IoT device is embedded with sensors which should be miniature into a tiny wearable pendant. These sensors are activated automatically in an unexpected situation. The Smartphone application JDMaN initially asks to deposit preset contacts that can be used to send emergency messages later in an unusual situation. The mobile app also asks users to give source and destination places as inputs before the user start the journey. As soon as the user enters the inputs the app shows number of routes from source to destination marking safe and unsafe routes. The smart pendant united with Smartphone application has an advantage of miniaturizing nature and low cost. The novel idea of this paper is to intimate the user about the safety of the route before starting the journey to reduce the risk of harm to women.

The paper is organized as follows: in section two, literature survey is presented; in section three, proposed method is described listing various software and hardware components which are followed by a conclusion and future work.

67.2 Literature Survey

This section throws light on various smart devices used for women's safety.

Authors in [1] developed a standalone device without an android application and with ATmega 328 microcontroller. It sends the current location of the woman to family and friends alerting them about the current location by making use of GPS and GSM modules.

In [2], authors proposed a safety device that is in the form of a wristwatch, which has a two-way talk feature by which the victim can contact friends and family, and also it contains a loud buzzer. The concept device is based on GEOFENCE.

Authors of [3] proposed a self-defense system with a button. When the button is triggered, it sends victims' location to her family members. It also alerts the surroundings with a prerecorded message.

In paper [4], authors have proposed an android application for the device (FEMME). Its features are sending SOS message, record audio, record video, and detect the hidden camera. The recording option of audio and video will help to have evidence.

In [5], authors developed a standalone device Suraksha. This device can be used in three different ways one the voice mechanism recognizes the voice of the victim and sends distress messages automatically, two a switch can be on/off, and third is that when the device is thrown, the force sensor of the device gives information to the victim's family members and friends about location information.

Authors of [6] developed a safety device that is in the form of a smart band, and this device gets activated by tapping it twice. This device has interesting features ones it gets activated as sending GPS location to police control rooms and pre-defined contacts when the device is thrown, the force sensor is activated and sends current location of the victim, piezo buzzer gets activated, and also shock is generated.

Authors in [7] developed a portable safety device known as SMARISA. It is activated by tapping the button after which the camera captures the image of the attacker and sends these pictures along with the current location to police and pre-defined emergency contact numbers by making use of a Smartphone.

In [8] proposed a safety device that needs fingerprint to get activated. The device cooperates with a buzzer to alert nearby people, location of the victim is sent to ICE contacts (In case of emergency contact)) through GPS and GSM module, shock generator, also some additional features like audio recording and display of safe place from the current crime location.

In the paper [9], authors have proposed a safety device that resembles a normal belt. This device incorporates the Arduino Board, GSM/GPS modules, screaming alarm, and pressure sensors. This device activates automatically when the threshold of pressure sensor gets crossed. It sends emergency messages every two minutes to the police and three preset numbers with an updated location. It also contains a screaming alarm and can generate electric shock.

In paper [10], authors proposed a smart shoe for women's safety. The components of the device are placed on the sole and side layers of the shoe. This device sends emergency messages to the emergency contacts on pressing the switch located toward the side of the shoe. It also includes a shock circuit that generates a shock of 440 kV, a camera that records live video.

In paper [11], authors proposed a wearable safety device that can be operated automatically without the need for the Internet. As the sensor's data cross threshold value device gets activated automatically, the data is sent to the cloud, where logistic regression is applied to the data. When it is identified that it is an emergency help

message which is been sent to emergency contacts. This device uses a Zigbee mesh network and hence does not need the Internet.

In paper [12], authors have a specialized device for rural women. They have designed a BECON device that works with the wireless network. The BECON information will reach central stations with the help of the nearest access point.

In [13], a smart garment was developed that incorporates an electronic device. This device will generate 3800 kV to help victims escape from the location. On multiple attacks, 80 electric shocks will be generated.

In [14], a mobile app is developed initiated by Channel [V]. On pressing the power button twice of the Smartphone, it sends location details to the contacts every two minutes.

67.3 Existing System

There are many other devices and mobile app for the protection of women. Some of the smart devices [20] are shown in Fig. 67.1, and some of the apps are Advanced Electronics System for Human Safety (AESHS) [15], ILA security, Life360 Family Locator App [16] and apps to detect location by shaking the phones [17, 18].

In the existing system, a safety device resembles a normal belt [9]. This device incorporates the Arduino Board, GSM/GPS modules, screaming alarm, and pressure sensors. This device activates automatically when the threshold of pressure sensor gets crossed; it also contains a screaming alarm and can generate electric shock.

The drawbacks of existing system are first it is operated only in automatic mode; second screaming alarm is not audible to a long distance. In proposed method, these disadvantages are overcome by operating the device in both automatic and manual

Fig. 67.1 Smart devices

mode. The screaming alarm is replaced by sending alert messages to nearby people who have installed the JDMaN mobile app for immediate help.

67.4 Proposed Methodology

As per the literature survey, there are various mobile apps and safety devices for the protection of women. These devices can be operated manually or automatically at the time of any unusual incident. But in the proposed method, an advanced safety measure is intimated to the woman. To the best of our knowledge, this is the first paper that proposes to give prior information about the route that the user has to travel (Fig. 67.2).

67.4.1 Software's

This section focuses on software components used in the proposed method (Fig. 67.3).

GPS and Google Maps

These two are navigation tools; GPS is divided into groups; each group is assigned a separate orbital path so that detection can be done from anywhere on the earth surface; it is useful to track the coordinates of the user. The uses of Google maps are many like finding nearby hotels, temples, petrol filling stations, hospitals, traffic density, etc. In our prototype method, the mobile app JDMaN works in similar ways to Google maps to find populated and unpopulated routes that guide as safety instruction to the user.

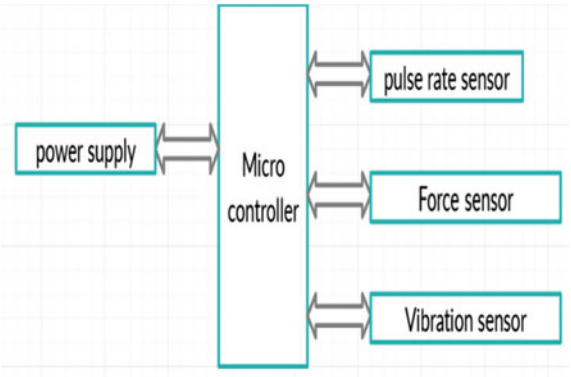

Fig. 67.2 Components of proposed method

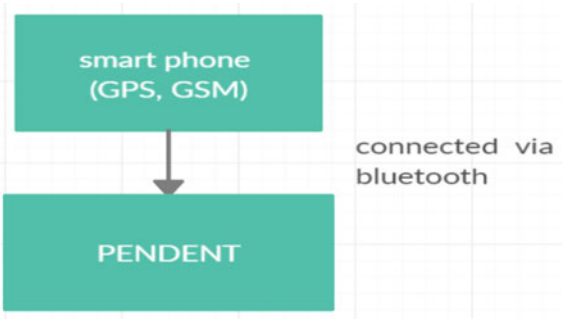

Fig. 67.3 Connection between Smartphone and pendant

GSM

The Global System for Mobile Communication is a digital mobile telephony system. It can accept any GSM network operator SIM card and work as a mobile phone. As it is compatible with Integrated Services Digital Network (ISDN) and can send and receive SMS, it is used to send messages to family, friends, police, and the nearby people in an emergency.

Smartphone—Mobile App (JDMaN)

Our proposed app is developed with the motivation of Google maps. These maps are used for tracking traffic, searching places, and for quick navigation. From these real-time applications, we are going to adapt traffic tracking that displays the traffic speed with colors. Our mobile app JDMaN shows various routes from source to destination indicating safe and unsafe routes as presented in Fig. 67.4.

- **Green** means an **unsafe** route as the route is not populated.
- **Red** means a **safe route** as the route is heavily populated.

67.4.2 Hardware Devices

This section focuses on hardware components used in the proposed method.

Smart Pendant

IoT-based pendant is built up by embedding sensors that get activated automatically and sent emergency messages to preset contacts and police shown in Fig. 67.5.

Force-Sensing Resistors

Lightweight sensing material, change in force across the device, can be changed in resistance in the terminals. Force-sensing resistors consist of a semi-conductive material—or, semi-conductive ink—contained between two thin substrates. As shown in Fig. 67.6, there are two different types of force-sensing resistor technologies—shunt mode and thru mode.

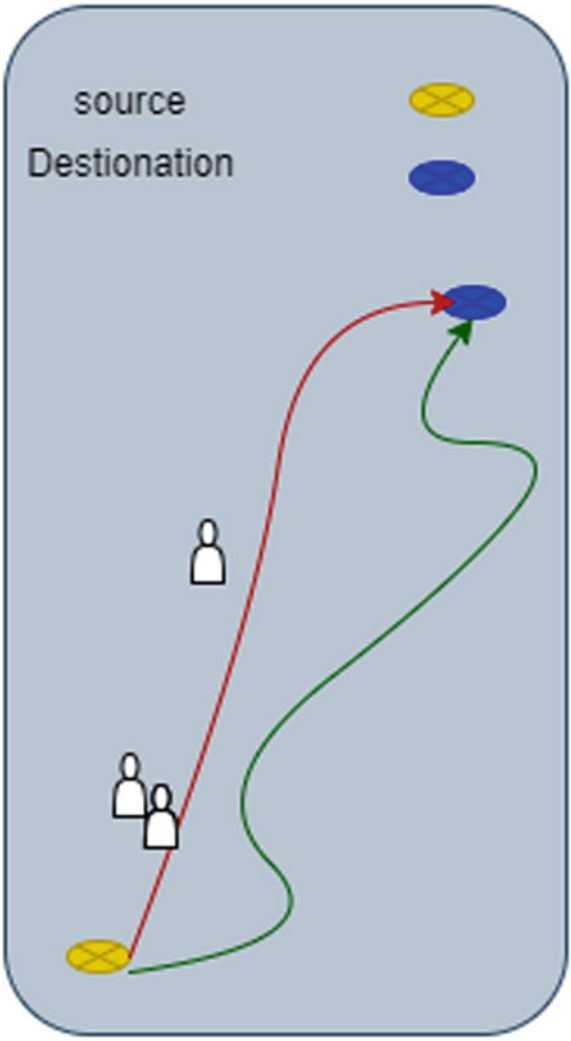

Fig. 67.4 Safe and unsafe routes

Shunt mode force-sensing resistors are polymer thick-film devices consisting of two membranes separated by a thin air gap. One membrane has two sets of interdigitized traces that are electronically isolated from one another, while the other membrane is coated with a special textured, resistive ink.

Thru mode force-sensing resistors are flexible printed circuits that utilize a polyester film as its two outer substrates. Silver circles with traces are positioned above and below a pressure-sensitive layer, followed by a conductive polymer. An adhesive layer is used to laminate the two layers of the substrate together.

Fig. 67.5 Smart pendant

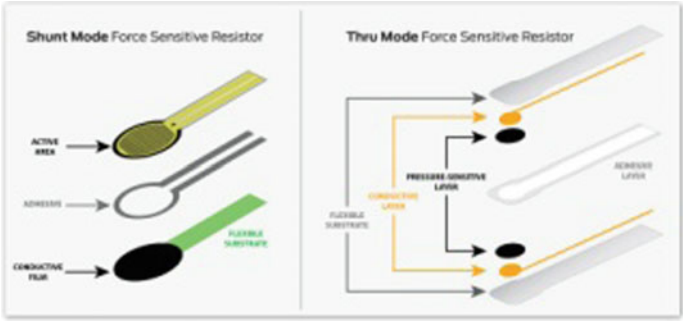

Fig. 67.6 This graphic illustrates the differences between the shunt and thru mode force-sensing resistor technologies

Vibration Sensor

A vibration sensor, also known as a piezoelectric sensor shown in Fig. 67.7, has many types that are used to measure the acceleration, pressure, and vibration changes of a device or system. It can be used alongside an Arduino or Raspberry Pi through the miniaturized.

The working principle of vibration sensor is a sensor that operates based on different optical otherwise mechanical principles for detecting observed system vibrations. The sensitivity of these sensors normally ranges from 10 mV/g to 100 mV/g, and there are lower and higher sensitivities which are also accessible. Vibration analysis can detect problems such as imbalance and bearing failures.

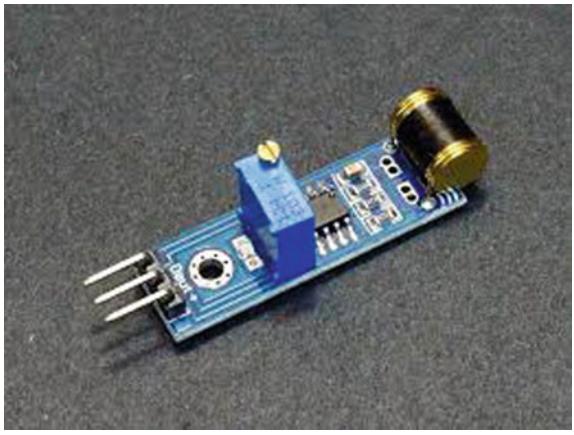

Fig. 67.7 Vibration sensor

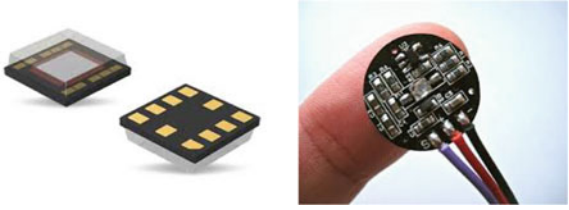

Fig. 67.8 Pulse rate sensor

Pulse Rate Sensor

The pulse rate sensor shown in Fig. 67.8 consists of a light-emitting diode and a detector like a light detecting resistor or a photodiode. The heartbeat pulses cause a variation in the flow of blood to different regions of the body.

Pulse rate sensors are available in wrist watches (Smart Watches), Smartphones, chest straps, etc. The heartbeat is measured in beats per minute or bpm, which indicates the number of times the heart is contracting or expanding in a minute.

Raspberry Pi

The Raspberry Pi is a small, stripped, low-cost, and credit card-sized computer that can be used to do many of the simple tasks like connecting to a computer monitor or TV using HDMI, Internet browsing, playing games, and even play HD videos. Figure 67.9 shows credit card-sized Raspberry Pi.

67.4.3 Working

The proposed method consists of an IoT circuit in a pendent and a mobile app on a Smartphone shown in Fig. 67.10. A pendant consists of a pulse rate sensor, vibration

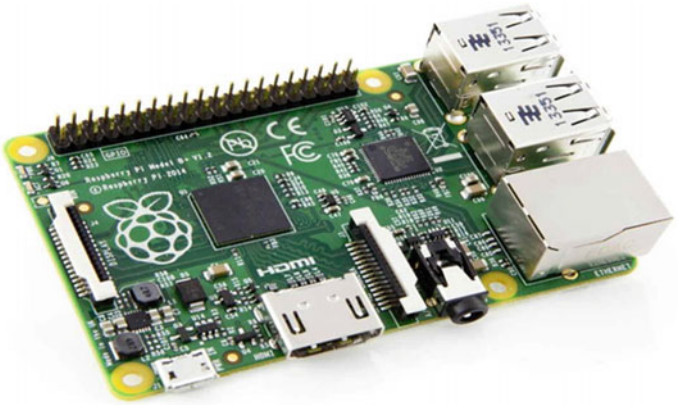

Fig. 67.9 Credit card-sized Raspberry Pi

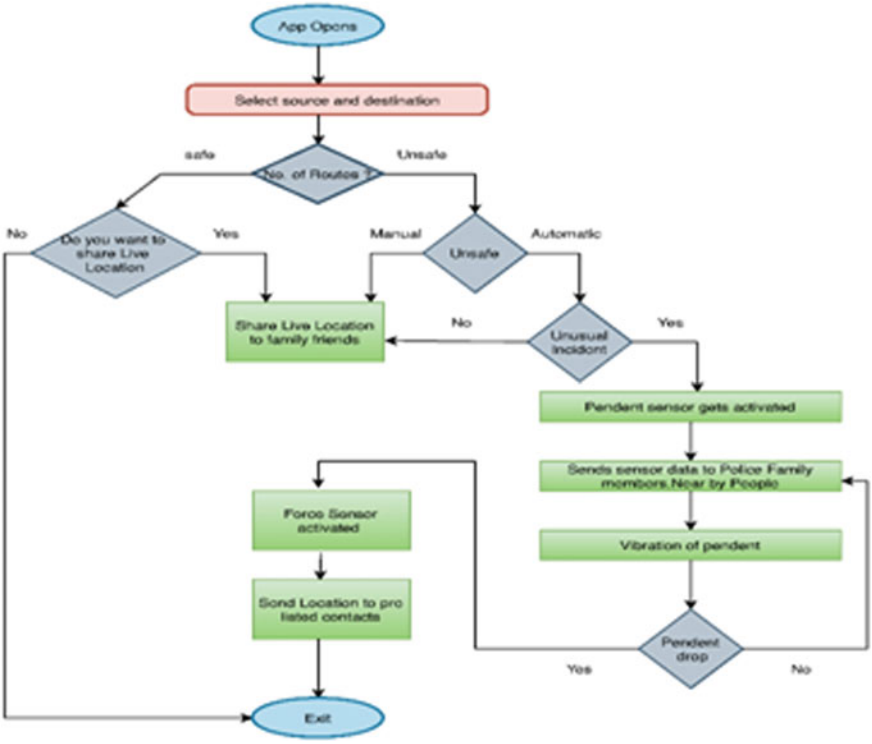

Fig. 67.10 A flowchart for mobile application working

sensor, and a force sensor. A mobile app works to give prior information about the safest route to women. The pendant and Smartphone are connected using Bluetooth.

The proposed methodology works as follows:

1. Initially, the user has to give input in the app about source and destination, and thus, the app shows number of routes from source to destination highlighting safe and unsafe routes. Safe route means populated route with more traffic of people, and unsafe route means low traffic or no traffic of people.
2. If the user selects a safe route depending on her choice, she may or may not share her live location with her family and friends.
3. If the user has to select an unsafe route in the worst case, she has to compulsory share the live location to her family or friends or both in manual mode.
4. If anything unusual happens in the unsafe route, the sensors in the pendent are activated automatically and the data location is sent to police, family, friends, and the nearby people who installed this mobile app for immediate help.
5. In case, if the pendent is thrown in an unusual situation, the force sensor in the pendant will send the last current location to the preset numbers.

67.5 Conclusion and Future Work

Our proposed system can provide safety for women who travel alone on roads, workplaces, and public transport. As the proposed system can be operated manually or automatically, it is the easiest way to use. As the women are intimated with safe or unsafe routes before making her alert about the surroundings, which no existing system has done yet. The vibration to the woman keeps her conscious without losing her senses. This system can make women travel more confidently and safely at any time of the day or night.

This system is a prototype so it has to be implemented and can be further improved by adding features like communication without the Internet and beneficial to rural women.

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