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Design of a Smart Safety Device for Women using IoT

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Abstract

Women safety has always been an issue even in these modern times with so much advancement in technology. Women are not safe anywhere and are most vulnerable when traveling alone into lonely roads and deserted places. Existing hand held safety devices for women require human intervention for activating the device such as pressing the button or shake the device etc after sensing the danger. We propose a solution which will try to overcome the disadvantages of the existing systems and also aim at providing false proof safety to women. The proposed work aims at designing an IoT based safety device that relies on providing security to women by fingerprint-based method of connectivity to the device and alerting nearby people and police when a women is not safe. An unsafe situation is sensedby fingerprint verification for a minute then it will automatically alert nearby people and police if the device senses no signal. Moreover, for first-hand safety, shockwave generator is also designed that women can use to attack the perpetrator. Additional features such as sending group messages, audio recording are also part of the proposed design. A mobile app is designed for women safety where safe locations from victim's current location will be shown on the map so that women can reach the safe place from her current location.

*Keywords:*Women Safety Device; IoT; Fingerprint Sensor; Shock Wave Generator

1. Introduction

Women safety has always been an issue even in these modern times with so much advancement in technology. Women are not safe anywhere and are most vulnerable when traveling alone into lonely roads and deserted places.

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Existing handheld devices that are available for women safety require women intervention to activate them such as pressing the button or shake the device etc after sensing the danger. However, for some reason if a woman has no time to activate it when she is danger, then the purpose of the safety device is not solved. In a country like India where the growth rate of crime is considered to be more than the growth rate of population, which includes burglary, murders, rapes, and many more women's safety is believed to be one of the most important issues.
According to a report by Thomson Reuters Foundation, India is ranked as a highly dangerous place for women world wide, India has the greatest number of child brides as well. In 2016, the number of reported rapes is almost 39,000. Experts that were interviewed for the reason why India is presumed to be dangerous for women said India is on top of the list because its government has done almost nothing to provide safety to women since the rape and murder of a student in early 20's in 2012 which prompted changes in the rape laws of the country. Most of the attacks on women happen when they are traveling alone or are in a remote area where they are not able to find any help or proper assistance. This paper proposes aIoT based solution to address the problem of women safety and that overcome the shortcomings of existing devices. The proposed design comprises of features to notify family members and nearby police station for immediate assistance when women are not safe. Moreover, a shock wave generator is a part of the proposed design which women can use to attack the perpetrator.

Some of the other features in the proposed work that provide additional support to women are as follows:

1. Sending group messages from the device as well as from the victims' phone.
2. Recording audio of the victim which may be later used as proof against the perpetrator.
3. Locating safe place from victim's current location on the map

2. Related Work

This section discusses the various works on designing safety devices for women.

Suraksha[2] is a stand-alone device which can be triggered in three ways either voice, switch, and shock/ force. Voice is the voice of victim. The device will recognize it and automatically send distress messages. Switch is a simple on/off trigger, and shock/force- whenever this device is thrown it will use force sensor to start functioning by giving the information of the location of the victim to her members of family and friends.

Poonam et al. [5] developed a safety device that uses an ATmega 328 microcontroller without any android application which makes it a stand-alone device. It uses GPS and GSM modules to track the location and then send it to the family members and friend, alerting them about the current location of the woman

A self-defence women safety system [7] is proposed whichwhen triggered by a switch, automatically sends the location of the victim to their concerned one.In addition, the device will also play a prerecorded message using speech circuit to alert the surroundings.

The device (FEMME) [4] proposed by the authors has an android application. Its basic functionality is to send an SOS message, record audio and video of the whole incident as evidence. It also has a module which detects hidden cameras using a radio frequency receiver, which collects/ detects electromagnetic waves that are emitted from the spy camera.

Kumar et al. [3] have proposed a device which is in a form of a wristwatch and works on the concept of GEOFENCE, which is a virtual boundary that triggers the application when the person is in a particular area. It also has the feature of two-way talk so that the victim may be able to contact her family or friends. The device also allows the woman to trigger a loud buzzer on the receiving side of the message even if their device is in silent mode.

SMARISA [6] is a portable device for women safety. It comprises of hardware components such as Raspberry Pi Zero, Raspberry Pi camera, buzzer and button to activate the services. It is activated by the victim by clicking the button. Upon clicking, the current location of the victim is fetched and the camera captures the image of the attacker which are then sent to police or predefined emergency contact numbers via the victim's smart phone.

A smart band safety device [1] that gets activated by tapping on the screen twice. Once activated, it sends the GPS location to the predefined contacts and police control rooms. It also has pulse rate sensor and temperature sensor to measure the pulse rate and body temperature of the person. The force sensor gets activated when the device is

thrown and it sends the current location of the victim. A Piezo buzzer siren also gets activated. The two metal points on the top of the band screen emits electric current thus generating shock.

Almost every existing hand held safety device for women requires human intervention for activating the device such as pressing the button or shake the device etc after sensing the danger. However, the proposed device relies on fingerprint-based method of connectivity to the device. The idea is that if there is no fingerprint verification on the IOT based device for a minute, then it will automatically alert nearby people and police.

3. Proposed Design for Women Safety Device

The proposed women safety device provides assistance to a woman who might be in an unsafe situation. The device is essentially ready for all the situations that might go against the will of the woman. Fig.1 shows the hardware design of the safety device. It uses Atmega 328 microcontroller. The design comprises of fingerprint scanner to activate the device, GSM (Global System for Mobile Communications) module for sending alert messages, buzzer for alerting the environment and shock wave generator for self defence. It has a LCD that displays the message.

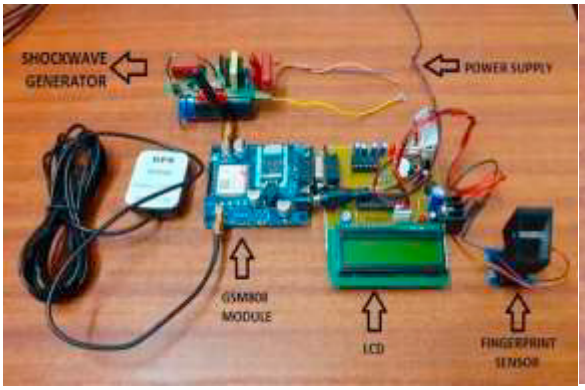

Fig. 1.Proposed Hardware Design for Women Safety

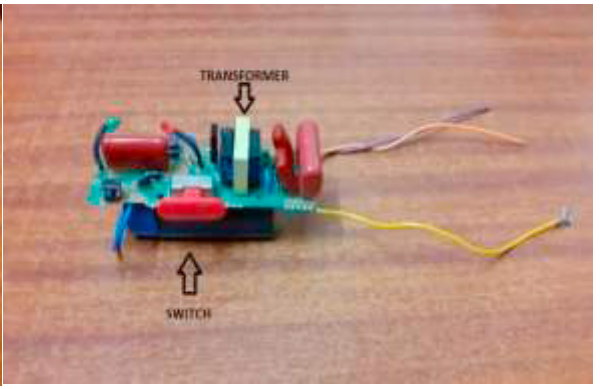

Fig. 2.Design of Shock Wave Generator

The working of the device is as follows:

The fingerprint of the woman must be registered initially and it is used to activate the device. As soon as the device is activated by the woman, it startsscaning the fingerprint of the woman for every minute. The time when no fingerprint is sensed by the scanner, the device will betriggered setting off a buzzer to alert the nearby public. As the device starts scanning the fingerprint only during emergency ie., only when the woman sense some danger, the quality of the device is not affected.

Moreover, the latitude and longitudedata which is receivedby the GPS is delivered to both the LCD and the GSM modem which will forward the message to the woman's family/friends. Thus, even if she is knocked down from behind and is not able to trigger an alert, the device will automaticallysend an emergency message to all the contacts listed by the woman as ICE contacts (In Case of Emergency contact) regarding the current location of the woman.

The design also includes shock wave generator that acts as weaponry and helps woman to defend herself. Fig. 2 shows the hardware design of shock wave generator that comprises of a switch, transformer and wires. One of the two loose ends of the wires is the high voltage source and the other acts as the ground for a return path. As these loose ends are not in direct contact with each other, the high voltage is unable to arc- off unless it touches the attacker's body which acts as a conducting path between the two ends.

The circuit consists of three main stages

- Power supply
- The oscillator
- Voltage amplifier

When the battery is fully charged, the voltage is applied to the oscillator stage. The transformer steps-up the oscillating frequency which works as a type of inverter. The output of the transformer is then transferred to the capacitors, where the current is stored and later is used to electrocute the attacker.

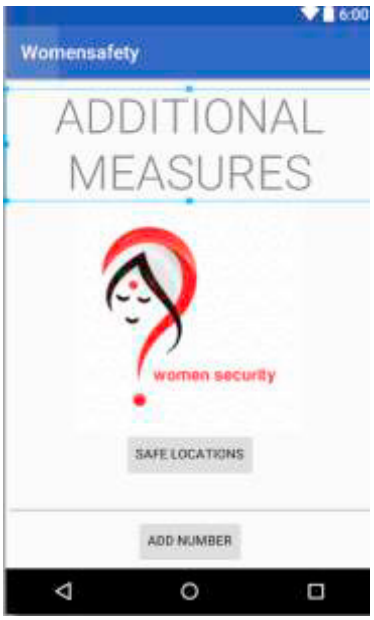

Fig. 3.Andriod Interface for Women Safety

Fig. 3 shows an android interface for women safety. The design also encompasses an android application that provides an additional safety features as listed.

1. Group messages will be sent from the device as well as from the victims' phone using this application.
2. An audio recording will be done so that the victim can use it as proof against the perpetrator.
3. Safe locations from victim's current location will be shown on the map using mobile app so that women can reach to safe place from her current location.

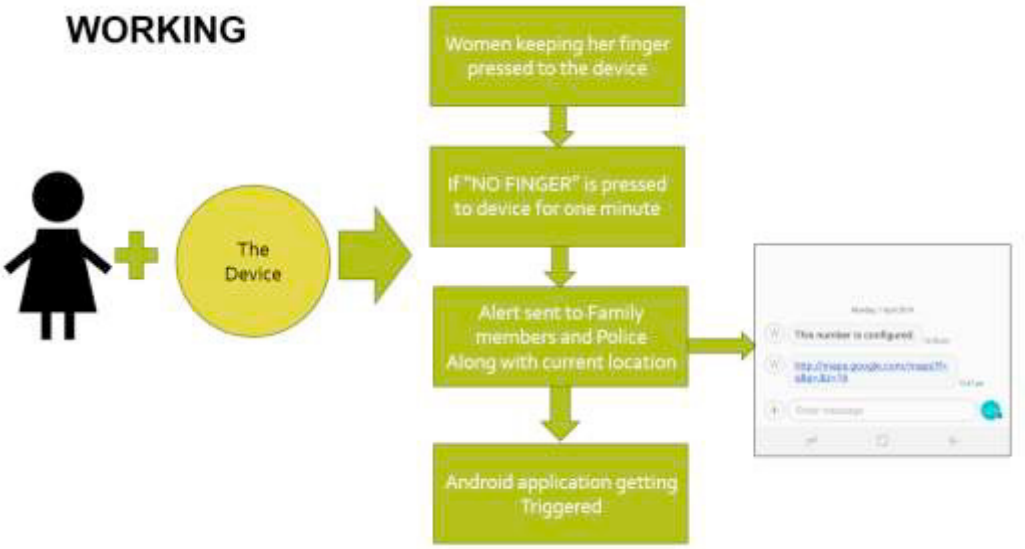

Fig. 4. Workflow of the Proposed Design

Fig. 5. Additional Features Supported through Android Application

Fig. 4 and Fig. 5 show the uniqueness of the proposed design in handling the sensitive issue of women safety as other devices rely on Women to press some button or make some movement in the handheld device. But it fails when she has no time to react. In this fingerprint-based method if the women are attacked from behind then also it will alert nearby people and police as our idea is that if there is no fingerprint verification on our IOT based device for one min then it will automatically alert nearby people and police. Besides sending alerts, the android application facilitates audio recording of the victim and suggests nearby safe locations.

4. Results

This section presents the results of the experiments conducted with the proposed hardware design and the

android application.

Initially, the GSM module is verified whether it is properly connected and configured as shown in Fig 6. After configuring GSM module, device prompts the user as shown in Fig. 7to record the fingerprint so that it can be used to access the device and verify credentials.

Fig. 6.Connecting with GSM Module

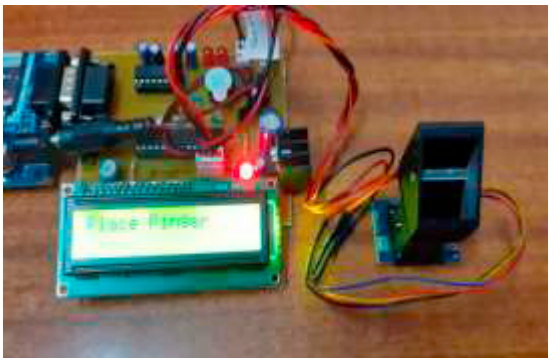

Fig. 7.Prompting for Fingerprint

Once the user activated the device with her fingerprint, the continuous monitoring begins, which keeps on checking for fingerprint on the fingerprint module. In case, there is no finger impression for one-minute buzzer starts to beep as shown in Fig. 8.

When the buzzer starts to beep, the GSM module sends message to all in case of emergency (ICE) numbers along with the latitude and longitude values which is taken from the GPS module as shown in Fig. 9. It also triggers the android application which suggests the victim for the possible safe locations as shown in Fig. 10.

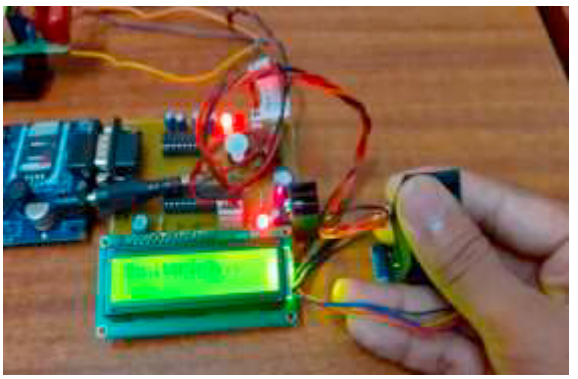

Fig. 8.Monitoring Fingerprint and Buzzer beeps

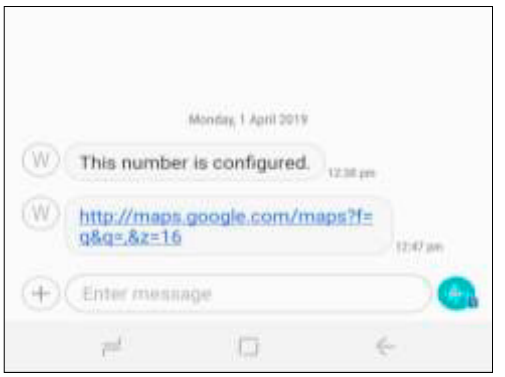

Fig. 9. Message Received by Family members/Police

Fig. 10.Android Application showing the Details and Map of Safe Location

5. Conclusion

The proposed women safety device aims at proving complete security to women in current scenarios. The fingerprint is used as unique identifier for the user so that no one can generate a false alarm and also to ensure that alert is raised only in stress situations. To provide comprehensive security, buzzer is included in the design, so that any nearby person gets alerted about the mis-happening. Sending text messages ensure that close relatives and police gets alerted with the current location of victim. In case women feels need of self-defense she can make use of shockwave generator to temporarily incapacitate the perpetrator. Besides, the hardware based design, an android application is developed to provided additional safety features like sending group messages, audio recording and identifying nearby safe location in map. The paper presents the prototype of a smart device for women safety, performance metrics have to be considered for further analysis to prove its efficiency.

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