A Raspberry Pi Based Smart Wrist Band for Women Safety Using IoT

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Abstract. Amongst the many difficulties that women face in this modern world. Sexual harassment, trafficking and physical abuse are some of the most common crisis faced by women. Thus, it is mandatory to find a solution in order to protect women from becoming victims to such assaults. This paper aims at putting together a device to protect women. The device which resembles a watch, can be worn on the wrist. In case of danger the victim can press the button in the device that will record the image of the assaulter through a Raspberry Pi based camera that is placed in the device. This image is immediately sent as message and mail to a set of pre-stored emergency contacts and the nearby police station through the app already available in the victim's phone. This particular system will also track the location of the victim and send it as mail or SMS along with the captured image. This device is also provided with a shock circuit which can be used by the victim for self-defence.

1. Introduction

In the modern world because of family situation and passion women need to take every step equal to men. But women cannot leave their houses at any time of the day without the fear of harassment. Due to these reasons, there is a need for women security system. All over the world women and children face so many obstacles in their daily life. They face humongous difficulties in every aspect of their life. Whether it is to do with work, education, or healthcare, they deserve the right to have systematic protection over abuse, violence, rape- the list is endless. Fig. 1. Shows the severity of the abuses against women. Thus, we have come up with a device which can provide women with safety while stepping out of their homes. This proposed system adopted IoT technology to improve the women safety. Using IoT, physical devices can communicate with each other over internet irrespective of distance. The proposed system is a real-time, portable and secure system which used to send alert message to their relatives and nearby police station. This system consists of Raspberry pi zero board, Raspberry pi camera, buzzer and a push button along with power supply. An android application is designed to simplify the user interface of smart band. Priorly, user has to install mobile application and select emergency contacts list (Mobile Number as well as Mail ID) to send information when they are in danger. When the button connected with raspberry pi is pressed, raspberry pi captures the image of the crime and send the emergency signal to the cloud database. As soon as emergency signal updated in the cloud, the android application will fetch the GPS location of user mobile and send it to cloud. Similarly, it sends the SMS to contact list given by user. After that raspberry pi send the image of crime along with GPS location to mail address.
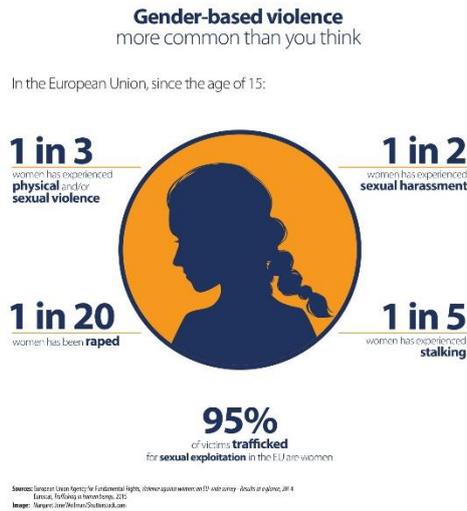
Fig. 1. Gender-based violence survey.

2. Literature Survey

The authors of this paper [1] have suggested a prototype of a product which uses flex sensor and a fall detection sensor which is not reliable as it can be triggered by the victim by mistake as well. This device supports a wireless camera which would be attached somewhere in the body which starts live streaming and sends the video to the control room. Also, as this product is a prototype, the size and cost of the product is uncertain. It is possible for the product to be bigger than the usual size of a wrist band which might attract unwanted attention.

The authors of paper [2] have suggested a product with an emergency button which when pressed will send "Help" message to 5 predefined contacts through GSM along with location. But the functions provided by this product is basic which is implemented in proposed product.

Smart foot device: The authors of paper [3] have come up with a device which can be attached to the footwear of the buyer. This device will send the details about the location of the user via a smartphone application when it is triggered. The disadvantage of this device is that, it can also be triggered by involuntary foot tapping action. Also, the victim's feet need to be on the ground for the device to work properly.

Watch me: This is an IoT based product which uses a pulse rate sensor which is triggered when the pulse rate of the victim is increased beyond a predetermined limit within a short period of time. This sort of trigger is not a reliable one as the pulse rate may increase or decrease due to physical activities as well. The authors of paper [4] claim that this system will automatically place a call to nearby control room and emergency contacts when triggered.

Suraksha: According to the authors of paper [5] this product is based on sensors which when activated will send alert messages to the emergency contacts and police along with location.

The authors of this paper [6] have made use of IoT and machine learning. This product makes use of temperature and pressure sensor. When triggered it sends the location of the user to emergency contacts even in the absence of internet by using Zigbee technology.

The paper [7] suggests a product activated by button press which sends the location of the victim to the police, family and friends. This product is also equipped with a shock generator for the safety of the victim.

The paper [9] authors have designed a cost-efficient product which makes use of galvanic skin resistance and body temperature sensors. It continuously monitors these parameters and send trigger signals when the conditions seem abnormal.

The paper [10] authors have come up with a smart jewellery which is a wearable device. This particular device can automatically sense, detect and identify physical assault through sensors. This device is also for elderly people who live alone. This device can automatically call the police services when it detects that its user is in danger.

3. Comparison and Validation

As mentioned, priorly the sole intension of this paper is to instil the feeling of safety and security in women as they step out of their houses every day. Thus, the authors of this paper are suggesting a system to do so.

There exist several such devices in the market. But the superiority of this device lies in the advanced technology which is being used. This idea uses the recent technology, Raspberry Pi which plays a major role in reducing the cost and size of the system thereby increasing its reliability and efficiency.

Most systems proposed use sensors to detect the sudden change in body function and thereby understand that the particular individual is in danger. But the disadvantage in this idea is that these sensors can also be triggered even during circumstances where the individual may not be in danger which can lead to unreliability, confusion and chaos.

This paper suggests a system which is combination of software application and hardware with a push button which can be triggered manually by the victim only when absolutely necessary.

The hardware also uses Raspberry Pi microcontroller which is smaller in size. This system uses Raspberry Pi based camera of 5-megapixel to capture images of good resolution and can also record videos. This is another special feature of this system which is unavailable in most of the existing products.

This system uses Firebase Cloud storage as memory for storing the emergency contacts list and also the image captured by the camera. This kind of storage has numerous advantages some of which are:

- Firebase Cloud Messaging (FCM) provides a connection between the server and devices that can deliver and receive notifications and messages in iOS, Android and the web at zero cost. This connection is not only reliable but also battery efficient.
- FCM can deliver messages instantly and also has minimal to zero coding involved.
- Realtime database makes data access simple from any device.
- Firebase provides easy authentication setup and fuss free maintenance for the system which usually takes several months to setup.

This system allows further development in the domain of product size which can be achieved by using polymer batteries.

4. Existing System

There already exits several such devices. The purpose of these devices is also to provide safety to women. Existing system uses the SMS to send alert message and location which cannot send the image directly. This system sends only image URL to contacts and concerned authority and to the pre-registered mail ids. The existing devices do not provide any means to self-defense to the user. Also, not all of the exiting devices are reliable. Most of these existing devices are also expensive. There are certain devices which have failed to fulfil their specifications as per reviews of the customer.

5. Proposed System

The idea behind this paper is to propose a system that provides women with safety in case of danger. This device looks like a wrist watch which can be worn by the victim. This device has a help button which when triggered will capture the image of the assaulter and send it to the emergency contacts which are prestored in the smartphone of the user through an application. This proposed system uses the Mail services as well as SMS to send alert mail/SMS to relatives and nearby police station when victim is under danger situation. It produces the loud sound to grab public attention. It is also equipped with electric shock device which can help victim to attack the criminal. Using android mobile application user can register

their details and can send SMS to police and relatives. In today scenario, we receive lot of unwanted messages via SMS. Hence, peoples don't give much importance to SMS. Also, some mobile operators cost separate charges for SMS and it takes lot of time to reach the recipient. But Mail services are effective and we can send image directly through mail.
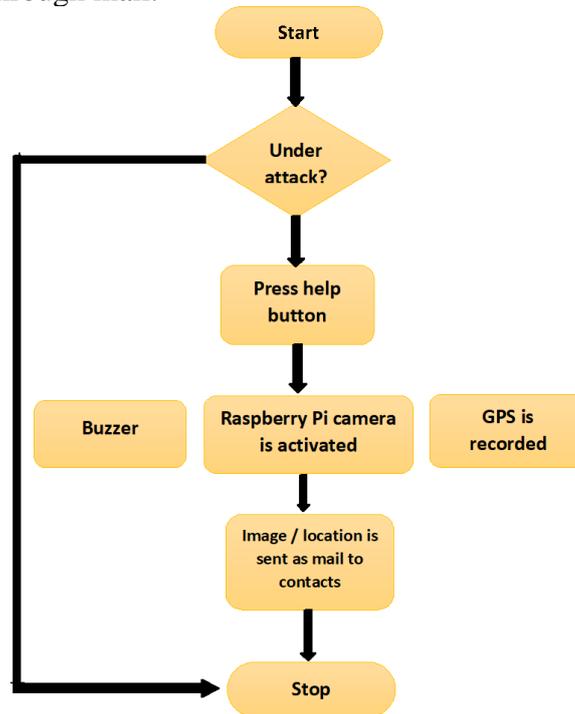
Fig 2. Flowchart of main operation

5. System Architecture

In this project 1GHz BCM2835 single-core processor with 512MB RAM (Raspberry Pi zero W) is used as a Main controller. This controller is small in size (65mm long by 30mm wide) when compared to other controllers and able to process and capture images. And this controller also has 802.11n wireless LAN, used to connect with internet.

In this system a Raspberry Pi based camera of module V2 is used which is a sensor having 8-megapixel Sony IMX219 image sensor which is custom designed to add on Raspberry Pi board. At the moment of button press, raspberry pi capture's the image and store it in local storage and update's the emergency signal in to the cloud database. Android application sends current location of user to emergency contacts through SMS as well as update location to the cloud. Then raspberry pi sends the GPS location and locally stored image to relative Mail Ids. An electric shock system is added with the system which is capable of producing high voltage electric pulses. These electric pulses can harm the human body which helps the user to attack the criminal. Fig. 3. Represents the idea of this paper.

S.No	Parts	Specifications	Price (Rs.)
1	Raspberry Pi camera	5-Megapixel	449
2	Lithium ion battery		
3	Raspberry Pi zero W	1GHZ, 512 Mb Ram	999
4	Button		57
5	Node MCU	ESP8266	339

TOTAL (approximate)	1,844

Table. 1. Parts used in product

6. System Functioning

This proposed product uses a 1GHz BCM2835 single-core processor with 512MB RAM (Raspberry Pi zero W) as a Main controller. This device has an emergency button which when pressed will capture an image of the assaulter or the surroundings of the victim using Raspberry Pi camera. This camera has 5-megapixel, capable of taking photographs of 3280 x 2464 pixels and captures video at 1080p30, 720p60 and 640x480p90 resolutions All software is supported within the latest version of Raspbian Operating System.

The location of the victim is also recorded using the GPS tracking system. The images thus captured and the location is sent to the emergency contacts [11] through an application which uses firebase database.

The Firebase Realtime Database allows storing and syncing between users in Realtime. It is a cloud-hosted NoSQL database. The Realtime Database is a JSON object which developers can manage in Realtime. This type of Database provides the application with current value of data and any updates to the data with a single API. One important advantage of Realtime Database is that it ships with mobile and web Software Development Kits, allowing application development without the need for servers.

This system also uses a Node MCU which runs on ESP8266 Wi-Fi Soc. The ESP8266 Wi-Fi Module provides access to the Wi-Fi network for any microcontroller. It is a self-contained SOC integrated with TCP/IP protocol stack. This particular node MCU is capable of hosting an application or offloading all Wi-Fi networking functions from another application processor [12].
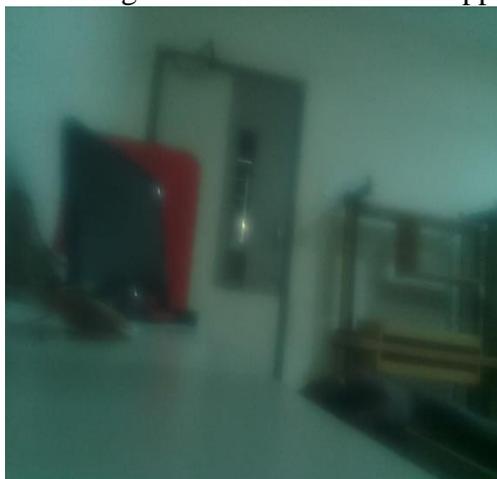
Fig. 3. Image captured by Raspberry Pi camera
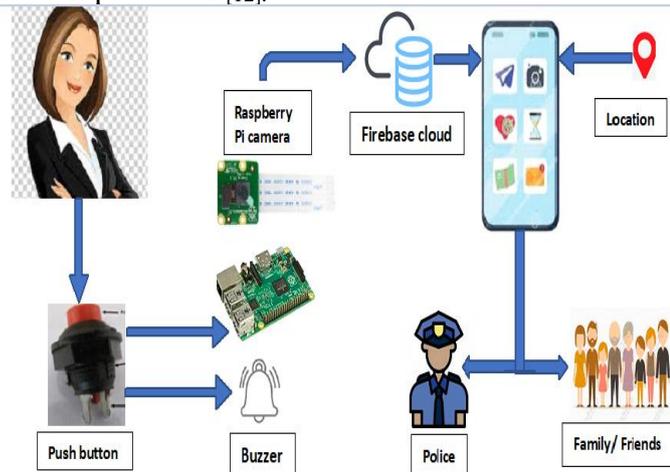
Fig. 4. System architecture

7. Future Scope

In the proposed system, the battery used is a lithium ion battery. But in the future products polymer batteries can be used to make the size of the battery smaller and thereby reducing the size of the system. Furthermore, any other means of safety other than the shock circuit can be added to the product. The product can also be tailored to be water proof to prevent short circuiting due to sweat. The product can also be updated enough to send the changing location of the victim without having to press the emergency button every time the location is changed.

8. Conclusion

The idea behind this paper is to provide women with the safety they deserve. It is only fair for women to expect to carry out their day to day activities without the fear of molestation or abuse. This device can also be used for the protection of children. The primary aim is to provide a reliable, cost-efficient device which makes use of the latest technology, and provides security for the user.

The device proposed makes use of Raspberry Pi zero W as main controller because of its small size and ability to capture and process images. The device has to be triggered manually by pressing the emergency button. Once the button is pressed the device will send the GPS location of the user to the police and the emergency contacts which has been stored in the application by the user. Along with the location, a picture of the crime scene or the assaulter can be sent by the user as mail and SMS. The primary aim of this paper is,

- To provide women/children with safety and security.
- To prevent sexual assaults and increasing crimes against women.

9.   References

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