

A Wearable Safety Devices for Women- A Survey

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Abstract:- Nowadays women harassment is increasing and women's safety is being questioned a lot. With the increasing crime rate parents are worried about sending their children outside. This is also greatly affecting women's empowerment. Women themselves are not willing to go far away from home for work. There are no strict laws framed to punish criminals. Immediate justice is not provided because of a lack of evidence. There are many technological initiatives by the Government to overcome this issue. But those initiatives are not enough to eradicate this. Many systems attempt to find a solution to this issue. Those systems include mobile applications, smart devices, stun guns, etc. They can operate either manually or automatically. But most of which require the victim herself to ask for help (ie., manually). Women who are weak and who got paralyzed during the assault cannot make use of these systems. Some systems focus on collecting evidence by using video/audio recordings. This paper examines the pros and cons of all the existing systems in this domain.

Keywords -- Women Safety, Smart devices, IoT.

1. INTRODUCTION

The Internet of Things (IoT) is becoming a major part of human life unknowingly. Giving machines the ability to communicate with each other and with humans is the Internet of Things. By utilizing the power of the internet, every machine can be controlled

by anyone in authority anywhere in the world. Nowadays women cannot roam around freely and their parents/guardians are not letting them go out. As the women's safety issues rise gradually, this is becoming a serious problem and stands as a primary barrier for women to do what they want. Times of India reported the data by the National Crime Records Bureau unveiling that 93 women are being raped every day. Even though there are strict laws, nothing has changed. IoT enabled smart devices can help women in these situations by analyzing the environment and the human body to send alert messages.

2. METHODS IN EXISTING SYSTEMS

Certain common methods are used in the existing safety device systems,

- Sensors
- Location
- Video/Image Capturing
- Communication

A. Sensors

Sensors are smaller devices that give data about the environment that it has been used. There are different sensors for detecting different parameters. IoT combined with sensors can be used to detect sexual harassment.

1. Pulse Rate Sensor

Pulse Rate Sensor when used near the wrist of a human body, gives data about the rate at which their heart is beating. If the heartbeat rate increases to an abnormal level, some systems confirm it as sexual harassment.

2. Temperature Sensor

Temperature Sensor gives data about the temperature of a medium on which it is used. If it's used close to a human body, the temperature of the human body can be detected which can be used to find sexual harassment.

3. Force Sensor

Force Sensors can measure the force between any two surfaces. A Force Sensor attached near to a human body will give information about the force applied over that area. This information can be used to figure out if a person is undergoing sexual harassment.

4. Flex Sensor

Flex Sensor measures the amount of bending or deflection happening over the component. It is also known as a bend sensor or flex potentiometer. The resistance over the component is directly proportional to the amount of bend.

5. Reed Switch

Reed Switch is an electromagnetic switch which can be activated/deactivated by a magnet. It's a small switch with two terminals enclosed inside a glass envelope. The terminals inside the glass may or may not be in contact with each other. But when nearing a magnet, it'll return to an opposite state.

B. Location

A GPS (Global Positioning System) is a module with a GPS receiver operating with the help of approximately 33 satellites to pinpoint the exact location of the receiver on the ground. This can be used to spot the location of the victim during a sexual assault. The received location data from this module can be sent to the police and the trusted contacts of the victim.

C. Video/Image Capturing

The camera modules are small devices with a lens that converts the light waves striking it into image data. These modules can be used to take photos and record videos. The recorded data can be used as evidence or can be analyzed to predict the harassment. This will not work great in a low light environment.

D. Communication

Communication plays a vital role during the harassment. If it's found that someone is being harassed using the sensors, then the message should be conveyed to the necessary people to save the victim's life. In simpler words, the information that is gathered from the victim should be sent to whoever can help. GSM (Global System for Mobile Communications) is a device that can communicate with other mobile devices using SIM (Subscriber Identification Module) inserted in it. It is considered to be the most reliable form of communication as of now. This device is capable of making calls, sending SMS/MMS, Fixed Dialing Number (FDN) and more.

3. LITERATURE SURVEY

The ideas proposed, applications developed, models suggested in this field are analyzed here:

A. Shock Circuit

B. Sathyasri et al., 2019 [1] proposed a Women Safety System which is capable of producing Neuro Simulation (Shock) when the trigger button is pressed. The system can also be triggered when abnormal body vibration is detected using the vibration sensor. After detecting an assault, the contacts are alerted.

Shaista Khanam et al., 2019 [2] proposed a Self Defence Device with GSM alert and GPS tracking with fingerprint verification for women safety which provides a basic

defense system for women. The main objective of this proposal is to help women defend themselves. This device makes use of a shock circuit which can be activated by authorized users using an inbuilt fingerprint module.

Shivani Ahir et al., 2018 [3] proposed a Personal Stun system which is a wrist band with an OLED screen powered by Arduino. There are two nodes on the top of the band which can be triggered to flow electric current by tapping on the OLED screen two times. This will also trigger the buzzer and send the coordinates obtained from the GPS module to the control room.

B. Video/Audio Capturing

Navya R Sogi et al., 2018 [4] proposed a Raspberry Pi based Smart Ring which also has a Raspberry Pi Camera. In case of any emergency, the user is required to press a button on the ring which trips the camera to capture images. The captured images are then stored in the server and the links to the images along with the location are sent to the emergency contacts set by the user.

Vishesh Sharma et al., 2019 [5] proffered a Smart Shoe with mechanisms similar to the previous one. In this system, all the components are attached to a shoe which the user will wear. Upon facing harassment the user can trip a button placed on the side of the shoe which will set off the camera to capture the images and send them to the emergency contacts along with the location coordinates.

Trisha Sen et al., 2019 [6] came up with a system that can be triggered with a voice command through Google assistant. On receiving an emergency voice command, the circuit will trigger the GPS, Video, Audio modules and send the data to the emergency

contacts with the help of GSM. This system also has a shock circuit. But it will be difficult for the person to take out their mobile phones to trigger the event through voice command. And it will be even worse in noisy environments.

C. Sensors

M. Kavitha et al., 2018 [7] propounded a Women Self Protecting System which makes use of a variety of sensors to monitor body conditions. These sensors include pulse rate sensors, temperature sensors, and motion sensors. The data from all these sensors are processed by a microcontroller which checks for a threshold value on all the inputs and detects the harassment or any kind of threats. There is also a panic switch to manually set off the system.

Prof. Sunil K Punjabi et al., 2018 [8] proposed a Smart Intelligent System for Women and Child Security which has a pressure switch (Solid Component). This can be set off by the user when they feel they are in danger and this will send the location coordinates to the emergency contacts set by the user followed by a call to those contacts. If the contact is not available to pick calls then the coordinates will be sent to the police. In addition to that, the user can also be locked to a geographical location using geofencing by specifying the fencing coordinates at the beginning. If it is detected that the user is crossing the fencing then the emergency contacts will be notified about it. This will be helpful for monitoring children.

D. Machine Learning

Muskan et al., 2018 [9] propounded a Women Safety Device Designed using IoT and Machine Learning. This system is one step ahead of all the other systems as it is using machine learning. The data about the temperature and pulse rate of the user is

collected through the sensors and analyzed using a Logistic Regression model which gives a binary value as the output (ie., Danger / No-Danger). The prediction accuracy of the model is the level of danger. If the predicted value is more close to danger (ie., 1), then the emergency contacts will be alerted by a call from the user.

Nandita Viswanath et al., 2016 [10] proposed a Smart Foot Device which has an accelerometer (Light Blue Bean) placed in the

footwear that sends the data to the mobile application installed in the user's device. In case of danger, the user can simply tap four times on the accelerometer using another leg. The application performs supervised learning on the data received to predict if it is a tap or normal walk. Based on the predicted result, the system will decide whether to alert emergency contacts or not. The overall accuracy of the prediction model is 97.5%. But there is a higher possibility for false positives.

TABLE I: RESEARCH WORKS IN WOMEN SAFETY DEVICES

Title	Author	Contribution	Disadvantage
[1] Design and Implementation of Women Safety System Based On Iot Technology	B. Sathyasri et al., 2019	A Women Safety Device with a neuro simulator is suggested with a trigger button and a vibration sensor to trigger the system.	The system requires human intervention both to set off the system and to shock the attacker.
[2] Self Defence Device with GSM alert and GPS tracking with fingerprint verification for women safety.	Shaista Khanam et al., 2019	A fingerprint activated and shock circuit enabled self-defense device is developed to help women defend themselves.	As it requires human actions, women who are weak and/or paralyzed during the assault will find it difficult to use.
[3] The Personal Stun-A Smart Device For Women's Safety	Shivani Ahir et al., 2018	An integrated wrist band with shock circuit, buzzer, location, and communication module is suggested. The shock circuit is inbuilt within the wrist band itself.	The shock is to be applied through the two nodes present on the top of the band. So, the possibility of hitting the assaulter is low.

[4] A Raspberry Pi based Smart Ring for Women Safety Using IoT	Navya R Sogi et al., 2018	A smart ring supported by a camera module captures the images of the assaulter.	Deciding a spot to place the camera can be challenging and also human intervention is required.
[5] Smart Shoe for Women Safety	Vishesh Sharma et al., 2019	A smart shoe with a switch to trigger the camera module is suggested.	The action of pressing the button needs to be performed by the user. Pressing the button in the shoe with the foot could be a difficult task.
[6] ProTecht – Implementation of an IoT based 3 –Way Women Safety Device	Trisha Sen et al., 2019	A voice assistant enabled system which is capable of triggering GPS, audio and video modules with just a single voice command.	The voice assistant needs to be accessed from the mobile phone. It will be difficult for the user to pull out their mobile phone during an assault/harassment.
[7] Women Self Protecting System Using Internet of Things	M. Kavitha et al., 2018	A combination of different vital signs monitoring sensors is used to detect harassment.	The human body's vital signs might react in the same way to two different situations.
[8] Smart Intelligent System for Women and Child Security	Prof. Sunil K Punjabi et al., 2018	A pressure switch is used to set off the system. Children can be locked in a geographical area by using geofencing.	The pressure switch is a solid inflexible component and might cause discomfort when attached in a dress.

[9] Women Safety Device Designed Using IoT and Machine Learning	Muskan et al., 2018	A machine learning algorithm processes the data obtained from sensors to predict the scenario.	Predicting from only two vital signs sensors might not be enough for accurate prediction. Approximation of the result needs to be done as Logistic Regression gives output in the range of $-\infty$ to $+\infty$.
[10] Smart foot device for women safety	Nandita Viswanath et al., 2016	A light blue bean with an integrated accelerometer is placed in the footwear which transmits the data to the user's mobile using BlueTooth.	Using machine learning on analog and predefined values is useless. Instead, a simple threshold can be set to differentiate between a tap and a walk. There will be a lot of false positives.

4. CONCLUSION

This paper gives a detailed analysis of all the devices developed using IoT to save women in danger. From a bird's eye view, it is very clear that all the existing systems require human mediation in some type of way. But it is very obvious that this will not be helpful for women who are weak and women who got paralyzed due to the shock from the assault/harassment. So there is a clear need for a fully-automated system to detect the assault with minimum or no human mediation at all. The accuracy of detecting assaults/harassments can be improved by using machine learning.

5. REFERENCES

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