International Journal of Future Generation Communication and Networking
Vol. 13, No. 1, (2020), pp. 1337-1347

Defense at Touch – A Sensor Based Hand-Held Device for Women Safety

[1]S.Bhuvaneswari ,[2]AkhilaKrishna.D, [3]Annapoorna.M, [4]Gayathri.G
[1]Assistant Professor, Department of Computer Science and Engineering,
Easwari Engineering College, Chennai-89
[2,3,4]Student, Department of Computer Science and Engineering,
Easwari Engineering College, Chennai-89
rajivanacse@gmail.com, ucmanu@gmail.com, dakhilakrishna@gmail.com,
gayathri.gopikrisnan@gmail.com

Abstract

The society we live in is not really safe for women. The crime rate against women is increasing rapidly. It has become a threat even to the employed women. This system provides a mechanism that responds quickly to help women when she is in danger. When a woman senses any danger , she can place a finger print which activates the device and then the location of the victim is sent as an SMS alert to the stored ICE contacts in terms of url The microcontroller is interfaced with a fingerprint sensor, an IOT module, a buzzer alarm to alert the people nearby that someone is in need and a shock driver circuit is implemented which is intended to hurt abusing person, due to which there is a chance for the women to escape from the situation . If the fingerprint is placed, it activates the shocking circuit for help. The program is coded in embedded language to prove the system functionality in real time. Thus, providing security and self-defence to women and this can be carried everywhere since it is small. To make the device more simple and compact we are in-cooperating waste management by using spare parts of old mobile phones which can no longer be used.

Keywords: *Internet of things(Iot), Global Positioning System, Short Messaging Service(SMS).*

1.INTRODUCTION

On an average, woman is getting kidnapped at every 44 minutes and raped at every 47 minutes per day[12]. In India security of women is a major concern. In India majority of the women have gone through some sort of harassment in public places. Nearly 81% of women and 43% of men have made a complaint on sexual harassment or assault. The reports prove that most of the incidents occurred in public places [11]. There is a rapid growth in crimes related to women such as harassment, rape etc. It is observed that woman is becoming a prey to all these dangers due to lack of public security and the inability to defend herself. In order to protect oneself, the woman must train herself in various self-defence technologies without waiting for external help. There are various mobile applications available that are meant especially for women safety, but these applications do not guarantee security

ISSN: 2233-7857 IJFGCN

at the time of emergency situations and could not assist her to defend herself. In figure 1, shows the national prevalence of sexual harassment and assault for women [11].

Figure 1: National prevalence of sexual harassment and assault

Women protection focused mainly on two technologies the mobile phones (37.2%) and wearable devices(19.4%)[13].Main technology used for women safety is Internet of things, system which consists of interrelated devices such as machines or objects that contains unique identifiers (UIDs) and allows the transfer of data over the internet without the intervention of mankind. In a broader sense, IoT comprises everything connected to the internet. IoT can be used in anything from sensors to smart phones to watches, making them 'connected together'. It can be used for both human-to-human and human-to-computer interaction. The amount of valuable data collected using IoT, supports other new technologies such as Artificial intelligence, Machine Learning, Virtual reality, Cloud Computing and so on. IoT allows the integration of the physical world directly into computer-based systems, resulting in improvement of accuracy, efficiency and economic benefit. Fingerprint recognition is a validation technique dependent on measuring the unique characteristics of humans. Each and every person has their unique biometrics. Thus the device is programmed in such a way that it makes use of fingerprint recognition for its activation. Due to fingerprints unique identity, other than the authorized user in control of this device will not be able to access it and this will prevent any misuse of the device.

This paper proposes a model called "Defence at Touch", a sensor based hand-held device which is all in one system concept. The main purpose of the device is to provide security and self-defence to women and this can be carried everywhere since it is small and to make the device simpler and compact, we are in-cooperating waste management by using spare parts of old mobile phones which can no longer be used.

2. Literature Survey

Deepak Kumar,ShivaniAgarwal [1] discussed the possible solutions for promoting women safety especially on social media websites .This paper uses sentimental analysis based on machine learning algorithm which uses hashtag messages that are widely spread across Twitter ,Facebook, Instagram etc. The data is collected from the twitter API and each word is compared with the positive and negative sentiments from the word dictionary and the positive or negative count is incremented based on which the result is categorized into positive, negative or neutral category. The issue in this application is that it is used only on social media platforms to provide awareness, but does not provide any solutions.

AbhiPriya R, Gayathri K, Dr. K. Kathiravan,[2] proposed a prototype that can be used in situations where the mobile phones are out of network coverage. Initially the women should enter the details of the emergency contacts. In case of emergency situations, the woman has to click the "Help" button to activate the application. The Radio Identification based Cognitive Radio technology has been used for access of white spaces in the frequency spectrum. GSM/CDMA mobile communication has been used for continuously sending messages for every two minutes. GPS has been used to share the victim's location. The issue is that the victim does not have an immediate solution to escape from the situation.

Shivani Ahir,SmitKapadia, JigarChauhan, NidhiSanghavi [3] , proposed a smart band that can be worn by the individual. The device should be connected to the mobile phone via Bluetooth. The victim needs to tap on the device which consists of the OLED screen. The latitudinal and longitudinal coordinates is shared to the ICE contacts and the Police Control Room. A beep sound is emitted from the buzzer attached to the device which works with the help of piezoelectric effect. The shock waves are produced from the device with the help of two nodes which are controlled by the relay. The issue is that it does not give accurate location information.

NanditaViswanath, Naga VaishnaviPakyala, Dr. G. Muneeswari [4], proposed a smart device that can be clipped to the victim's footwear. The device consists of a Bluetooth Arduino microcontroller embedded with a tri-axial acceleration sensor. The user's mobile phone and the smart device are connected by the Bluetooth Low Energy connection. The orientation of the foot of the user with respect to the three perpendicular axes is measured by the accelerometer. The device is programmed such that when the user taps the left foot from behind the right foot four times, the accelerometer captures a change in the reading in the z-axis which in turn sends an alert to the smart phone and shares the location of the victim to the predefined emergency contacts. The issue is that the victim has to wait for the arrival of the police or the concerned person.

SaumyaPandey, Nikita Jain, AditiBhardwaj, Dr.GagandeepKaur [5], Vimal Kumar, proposed a mobile application named "Reach360" for women safety. Initially the application requires the woman

ISSN: 2233-7857 IJFGCN

to enter her details for signing up. On shaking the mobile, the application opens and gets activated. The application generates a unique code for every user. The user's location can be tracked using unique code during emergency situations. This application can also detect the crime rate in a particular area. It uses NLTK for information extraction, Heat-map visualization for crime alerts and GEOFENCING for proximity alerts. The issue is that the victim does not have any means to escape from the situation.

Trisha Sen, ArpitaDutta, Shubham Singh, VaegaeNveen Kumar [6], proposed a three way safety module. The prototype contains a button which when pressed produces shock through the nerve simulator. A Camera has been attached to record videos of the evidence and is stored in Raspberry Pi. The GSM module has been used to send SMS alerts and to make calls to the emergency contacts. The GSM is also interfaced with a microphone and speaker so that the communication can take place in both the ways. The GPS has been used to share the location of the victim. The voice command from the user through a mobile application has been used to activate the device. The issue is that if the voice is not feasible then the device does not get activated.

RaviSekharYarraPothu, BramarambikaThota [7], proposed a mobile application named "Abhaya". Initially the emergency contact numbers should be saved in this application. In case of emergency situations the user should press the "Start" button. The application continuously sends the url of the location to the emergency contacts for every five minutes and also makes a call to the first specified contact. The "Stop" button needs to be pressed for disabling the process. The issue is that the application does not provide any solution for self-defence.

Muskan, TeenaKhandelwal, ManishaKhandelwal,PurnenduShekharPandey [8], proposed a wearable device that contains a temperature and pulse rate sensor which sends data to the Arduino board and the data has been stored in the cloud. Logistic regression algorithm has been used which compares the data with that of the previously stored data. If there is an abnormal change in the user's body temperature and the pulse rate then an emergency alert message is sent to the emergency contacts. ZigBee mesh network has been used so that the device can work in places where there is no internet connection. The issue is that the device does not work in situations where there is no abrupt change in the temperature and the pulse rate of the victim.

Navya R Sogi, PriyaChatterjee, Nethra U, Suma V [9], proposed a device named "SMARISA" designed in the form of a ring like structure. The device consists of a button which when pressed enables the Raspberry Pi Nano that can capture the picture of the attacker. The device needs to be connected with an Android application installed in a smart phone to track the current location of the casuality. The location url and the image is sent to the emergency contacts. A Buzzer has been used to

ISSN: 2233-7857 IJFGCN

generate a high frequency screeching alarm to alert the people in the current locality. The issue is that the device can easily be misplaced.

Priya Chaudhari, RamKumarKamte, KartikKunder, Ann Jose, Sweedle Machado [10], proposed a mobile application named “Street Smart” for women safety using augmented reality. This application requires the user to login and enter the emergency contact details. The user needs to hold the camera in a particular location to detect if it is a “Safe Street” or “Unsafe Street” along with the articles or reviews posted about that location. In case of emergency the user can make calls or send SMS of his location using GPS technology to the nearest police stations and emergency contacts. The user can also post reviews about his experience using Wikitude SDK, and it can be viewed by other users. The issue is that the user needs to hold the camera in every location he travels which is not practically possible and is time consuming.

3. Proposed Work

Initial step includes the victim being attacked by the predator, which is when the first component comes into play. Prior to the activation and usage of the device, storage and verification of the user’s finger print is done. When the time of activation comes, the fingerprint is placed on the sensor and if the metrics match, authentication and verification is done. This initiates the entire process, first being the buzzer incorporated in the device going off. Simultaneously, the server is updated saying the victim is in danger and alert messages are sent to ICE (In Case of Emergency) contacts. The immediate next step is the generation of shock waves, which is emitted from two steel pins situated at the edge of the device. As human skin is a good conductor of electricity, it becomes easier for the victim to bring down the predator. Figure 2 represents the proposed device system architecture.

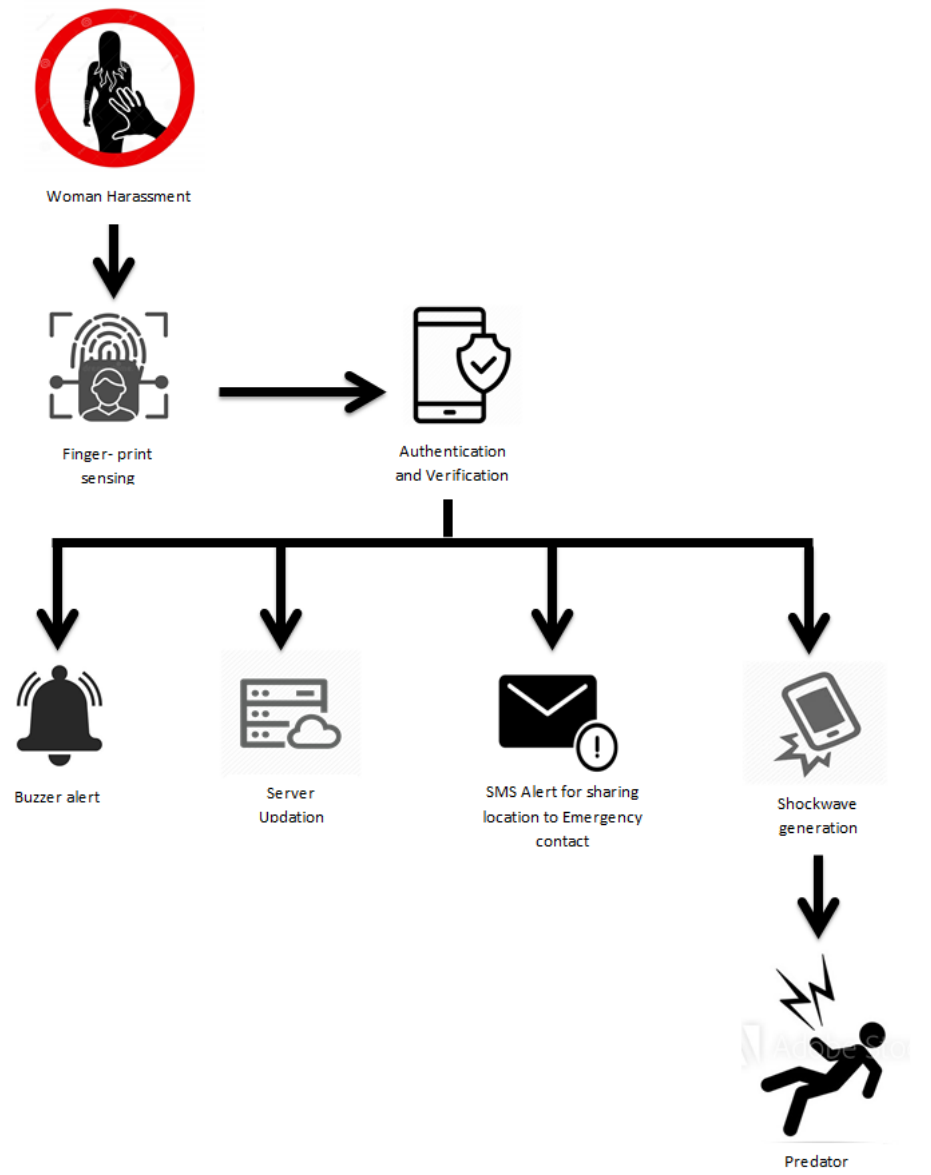

Figure 2. System Architecture

It consists of the following modules to achieve the result:

LIST OF MODULES:

1. Biometric authentication and buzzer alert.
2. IoT based location sharing and server updation.
3. Shockwave generation based on switching mechanism.

3.1 Biometric authentication and buzzer alert

In this module figure 3, the user has to first register her fingerprint with the help of a fingerprint module. The fingerprint module can be directly interfaced with the arduinonano. On registering, an ID is created and stored in the device. At the time of registration the emergency contact

number is also stored along with the fingerprint. The overall creation and storing of ID are done in Embedded C. The platform used to code is Arduino IDE. The code is then uploaded to the arduino nano. In case of an emergency situation when the user places her fingerprint, the user's biometric data is authenticated and authorized. In this process the fingerprint data is verified with the stored ID. If it is a valid data then the device gets activated by enabling the buzzer alarm. If the fingerprint does not match with the stored ID then the working does not proceed further. Arduino NANO is used for verification of the fingerprint. A 5v power supply is given to the digital pin of the buzzer which gets activated when the data is true resulting in an alarm to alert the people nearby. The buzzer has a sound pressure level of 85dB min.

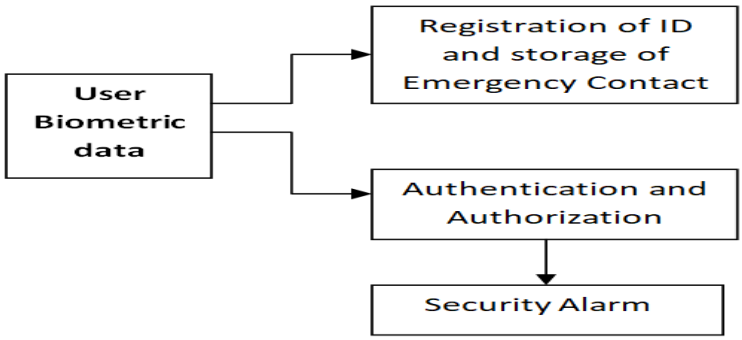

Figure 3 Biometric auth entication and buzzer alert

3.2 IoT based location sharing and server updation

In this modulefigure 4, the mobile phone and the device are interfaced via a Wi-Fi module. When the user's data is validated, an SMS alert of the victim's location is shared to the emergency contacts and updated in the web server for further investigation based on IoT. The SMS is continuously sent for every one minute. The SMS consists of a help text and also the location of the victim in terms of a url. On clicking the url, the page is directed to the google maps which helps the person to track the exact location of the victim. In the server part the victim's location, date is updated. This server is updated every time the user activates the device using her fingerprint.

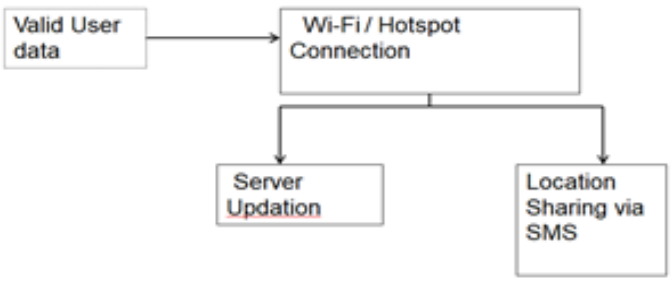

Figure 4. IoT based location sharing and server updation

3.3 Shockwave generation based on switching mechanism

Figure 5, the shocking mechanism is incorporated where the rest of the modules are interfaced with this component and brought together. The alert messages, server updation, buzzer being set off happen simultaneously along with the manually initiated shock waves. The shock waves are produced with the help of the two pins attached to the device which is enabled by the driver circuit. The driver circuit acts as a relay switch. The command to the driver circuit is given from the microcontroller. When the predator's skin comes in contact with the pins it produces shock waves of 5 volts , which sets free the victim from the predator for a few minutes.

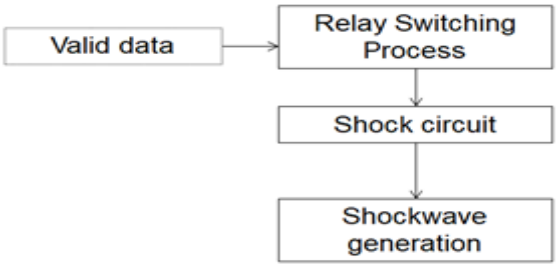

Figure 5. Shockwave generation based on switching mechanism

4. Results

This section gives the implementation of the device.

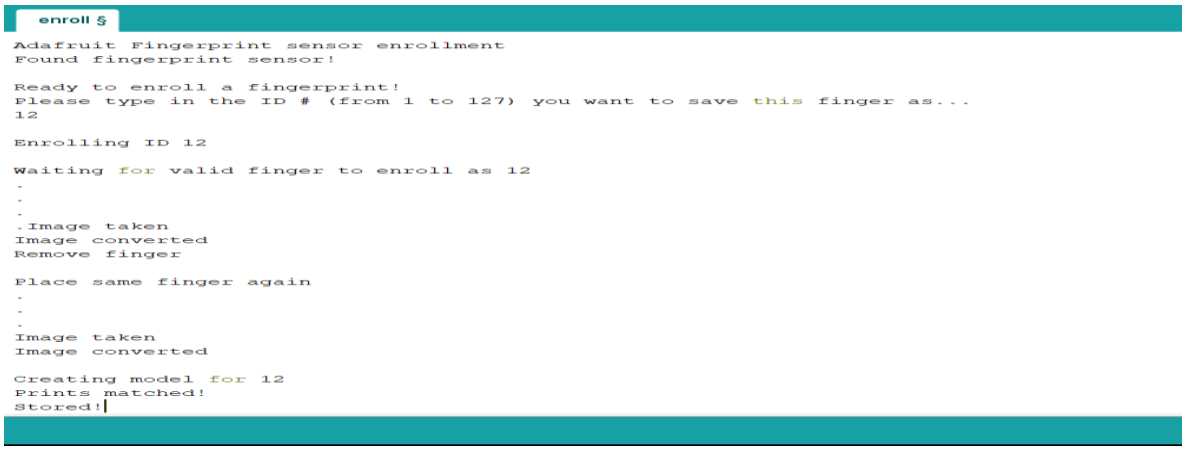

Figure 6. Screenshot Of Fingerprint Enrollment

The above figure represents Fingerprint Enrollment using the Arduino IDE Platform. Once the fingerprint sensor is ready for enrollment, an enrollment ID is selected between the range of 1 to 127, where the fingerprint will be stored. Once the ID is entered, the user is prompted to register her fingerprint and the image is captured. For confirmation, the process is repeated again to ensure that both the fingerprints match. Since the fingerprints matched, it is stored in the corresponding ID.

Figure 7. Screenshot of the alert message

Figure 7 depicts the alert message that has been sent to one of the ICE contacts by the victim. The messages will continuously be sent till the action is terminated by the victim.Attached with the alert message is the location of the victim which is shared in the form of a link along with the address which is shown in Figure 8.

Figure 8. Screenshot of the location of the victim

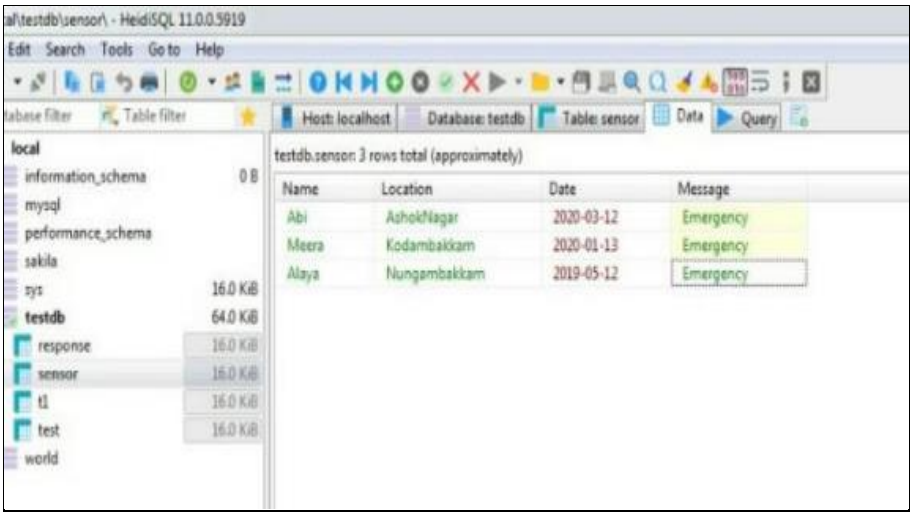

Figure 9. Screenshot of the Web server updation

The above figure represents the data that is updated in the server for further investigation. The figure shows the data such as name of the victim, the location of the victim, the date on which the incident took place and also an alert message. Further process includes shock wave generation from the device which acts as a tool for self defence.

5. Conclusion

Many systems and applications have been developed for tracking the location of the victim and to alert the police department. Some systems also provide self-defence for the victim. But the major disadvantage is that these devices can be used against the victim itself.The proposed device is authenticated Self Defence Device which is the best tool for a woman to feel safe, secured and defend herself. This device provides authenticated use that is only the victim can use and denies the use of other third parties. The authentication also prevents from generating false alarms. Moreover, the device comprises various modules such as buzzer, shock wave generator and also enables location sharing. The buzzer (85 DB) is also used in order to provide security to the victim by alerting the nearby people and for sudden attacks, shock wave of 5v is generated. All these functions occur simultaneously and also the device acts quickly without any delay when an authorized data is encountered. The overall aim of this design is to make the device function only by the victim and also to provide a compact and effective in any kind of dangerous situations.

6. References

[1] Deepak Kumar, Shivani Agarwal, “Analysis of Women Safety in Indian Cities Using MachineLearning on Tweets”, **(2019)** Amity International Conference on Artificial Intelligence.

[2] R. Abhipriya, S. Aysha, K. Gayathri, and K. Kathiravan,"3S: A Radio Identification based ContinuousSpectrum Sensing Protocol for Safety ofWomen in Cognitive Radio Networks", International Conference on Communication and Signal Processing, April 6-8, **(2017)**, India.

[3]ShivaniAhir, SmitKapadia, Prof. JigarChauhan, Prof. NidhiSanghavi, "The Personal Stun- a Smart Device for Women's Safety", **(2018)** International Conference on Smart City and Emerging Technology.

[4]NanditaViswanath, Naga VaishnaviPakyala, Dr. G. Muneeswari, "Smart Foot Device for Women Safety", **(2016)** IEEE Region 10 Symposium (TENSYMP), Bali, Indonesia..

[5] SaumyaPandey, Nikita Jain, AditiBhardwaj, Dr.GagandeepKaur, Vimal Kumar," Reach360:A Comprehensive Safety Solution", Proceedings of 2017 Tenth International Conference on Contemporary Computing (IC3), 10-12 August **(2017)**, Noida, India.

[6] Trisha Sen, Arpita Dutta, Shubham Singh,VaegaeNveen Kumar, "ProTecht – Implementation of an IoT based3 –Way Women Safety Device",IEEE Conference Record # 45616, ICECA **(2019)**; IEEE Xplore ISBN: 978-1-7281-0167-5.

[7] Ravi SekharYarrabothu, BramarambikaThota, "ABHAYA: AN ANDROID APP FOR THE SAFETY OF WOMEN",IEEE INDICON **(2015)** 1570191849.

[8] Muskan ,TeenaKhandelwal, ManishaKhandelwal, PurnenduShekharPandey, " Women Safety Device Designed using IoT and Machine Learning", **(2018)** IEEE SmartWorld, Ubiquitous Intelligence & Computing, Advanced & Trusted Computing, ScalableComputing& Communications, Cloud & Big Data Computing, Internet of People and Smart City Innovations.

[9] Navya R Sogi, PriyaChatterjee, Nethra USuma V," SMARISA: A Raspberry Pi based Smart Ring for Women Safety Using IoT", Proceedings of the International Conference on Inventive Research in Computing Applications ICIRCA **(2018)** IEEE Xplore Compliant Part Number:CFP18N67-ART; ISBN:978-1-5386-2456-2.

[10]PriyaChaudhari,RamkumarKamteKartikKunder,AnnJose,SweedleMachado, "Street Smart: Safe Street App for Women using Augmented Reality", IEEE **(2018),DOI:** 10.1109/ICCUBEA.2018.8697863

[11] http://www.stopstreetharassment.org/our-work/nationalstudy/2019study/

[12]B. Sathyasri, U. Jaishree Vidhya, G. V. K. Jothi Sree, T. Pratheeba, K. Ragapriya, "Design and Implementation of Women Safety System Based On IotTechnology",International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-7 Issue-6S3 April, 2019.

[13] Lauren F.CardosoSusanB.SorensonOliviaWebbSaraLanders, "Recent and emerging technologies: Implications for women's safety", Technology in Society,Volume 58,August 2019,Article 101108.