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IOT BASED WEARABLE WOMEN SAFETY DEVICE

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***Abstract*— Because of the increase in violence against women since recent years, women's safety has become somewhat of an issue. As of now there is no ideal solution to this problem. Previously existing apps and devices are not very effective because they need a lot of user interaction to work properly. The devices that are currently in use capture the human body temperature and heart pulse in order to trigger an alert in the occurrence of an emergency. When a person runs, every human has a different body temperature and heart/pulse rate pattern, by using a set threshold to detect an emergency situation and then triggering an alarm is not the best way, and this is where pre-existing systems fall back to produce an alarm in case of an emergency. As a result, the aim of this paper is to design a wearable women safety system that reads and gathers patterns such as body temperature and pulse rate while running. When the input readings are greater than normal, the system will automatically call and send message accordingly to several people, as well as the venue, so that help can be sent to the person who is in troublesome situation.**

***Keywords*— Internet of Things (IOT), Women safety.**

I. INTRODUCTION

Women have an important role to play in the country's bright future. Due to the fact that some societies hold a bad attitude in regards to the crimes committed against women, various crimes against them go unnoticed and are not recorded. Victims who try to report assaults committed against them to society are subjected to a variety of humiliations and misjudgment. In India, only one out of every four cases results in a proper conviction not to mention it is a lengthy process. To construct the best answer to this situation, proper safeguards should be taken. This study suggests a wearable device based on the Internet of Things approach for women's safety. This device detects dangerous circumstances automatically according to the criteria that is set to it and it alerts the appropriate authorities such as the police and family members of the victim on time. It assists women in escaping dangerous situations as well as it makes sure that women have enough safety resources to use by assisting them in times of need. It can also be used to collect the evidences of the unfortunate situation faced by the victim.

II. PROPOSED ALGORITHM

Our proposed system is a wearable device for women that includes pressure, pulse-rate, and temperature sensors, as well as Node MCU, GPS and software application, to identify a probable atrocity and send a message identifying her whereabouts to her friends and relatives. Provide a button on the wearable that may be used to manually send a notice if the victim is able to react. The sensor is Node MCU compatible. It aids in the rapid acquisition of accurate pulse measurements.

A. Block Diagram

The block diagram of the system in Fig. 1 depicts all of the device's components. Three sensors, including pressure, temperature, and heart rate sensors, are employed to automatically identify any atrocities. The pressure sensor detects whether any pressure is being applied on the lady that is excessive. The temperature sensor is used to detect temperature variations. The pulse-rate sensor is used to identify irregularities in the woman's pulse rate. These three sensors' readings are combined to identify any critical scenario. The device also has a push button that the lady may use if she feels threatened. When one of the two events listed above occurs, the buzzer sounds to inform anyone around that the lady is in danger. The lady's location is then determined using the GPS module, and using iot the message is delivered to her family.

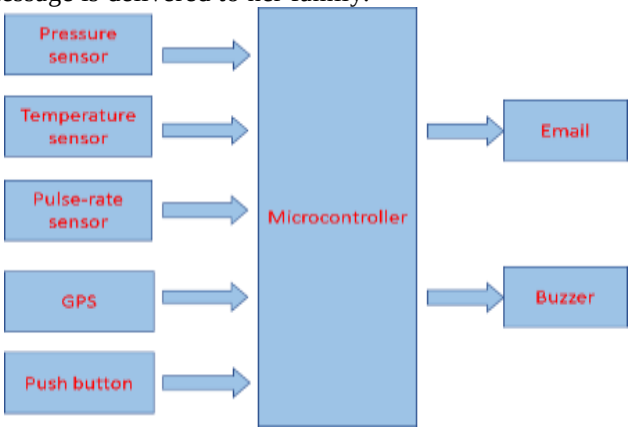

Fig. 1. Block diagram of proposed system.

B. Components

The prototype uses the following components

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1) **Pulse-rate Sensor**: The Pulse Sensor (see Fig. 2) is a plug-and-sense heart rate sensor that is very tiny in size and affordable in cost.
2) **Pressure Sensor**: This is a force-sensitive resistor (see Fig. 3) with a sensing region that is circular and has a diameter of 0.5″. The force sensitive resistor will change depending on how much pressure is applied. The force exerted has an inverse relationship with resistance.

Fig. 2. Pulse-rate sensor

Fig. 3. Pressure sensor

3) **Temperature Sensor:** The NTC Thermistor temperature sensor module (shown in Figure 4) is a compact, low-cost sensor that is extremely sensitive to ambient temperature. This sensor is used to detect the temperature of the surroundings. Temperature detection ranges from 20 to 80 degrees Celsius.
4) **Push Button**: When the push button is pressed, two points are contacted, activating the alert mechanism (see Fig. 5.)

Fig. 4. Temperature sensor

Fig. 5. Push button

5) **GPS module**: GPS is a real time location tracking device. In our project we have used GPS to track victim's real-time location. The GPS module consists of 4 pins namely 5V, TX, RX, GND.
6) **Buzzer**: This is a 5V passive buzzer that may be mounted on a PCB (see Fig. 7.). It's utilized in electrical designs to include Audio Alert. The coil element produces an audible tone and operates on a 5v supply.
7) **Microcontroller**: The microcontroller is used in our project is Node MCU to manipulate the serial operation based the program present in the output is taken from one of the four ports. NODE MCU has the ability to perform WIFI related activities. That's the reason it is widely popular as WIFI module.
8) **Power supply**: The controller is powered by a 12 V rechargeable Li-ion battery (see Fig. 9), which then delivers the appropriate power to all sensors and modules linked to it.

Fig. 8. Arduino Uno

Fig. 9. 12V Battery

C. Manual Mechanism

The process flow that happens when the ladies are in a position to respond is called the manual mechanism (see Fig. 10). It has a button that the lady may touch when she feels threatened. The buzzer activates when the button is hit, making a loud noise to warn anybody around who can assist her. The alarm mechanism is then activated.

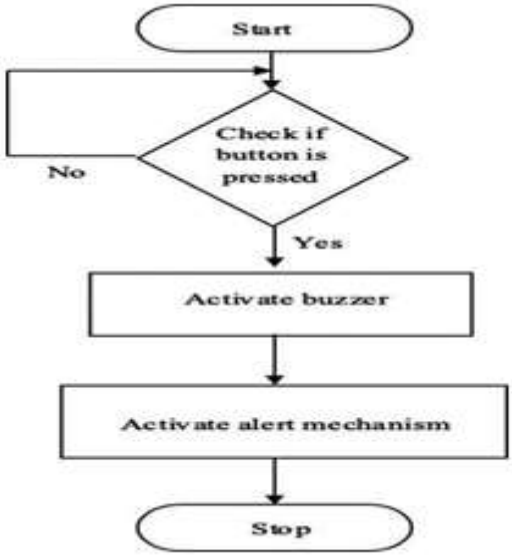

Fig. 10. Flow chart of manual mechanism

D. Automated mechanism

The women may not be able to react and operate the manual mechanism in the majority of instances. To avoid false positives, automate the process with pressure, temperature, and pulse-rate sensor (see Fig. 11.) and combine the values of these sensors. The alarm mechanism is initiated when any of the two sensors detects an irregularity.

The pressure sensor is a force sensing resistor-based sensor. The resistance diminishes rapidly with a slight increase in force. The resistance value is transformed into an analog voltage between 0 and 5 volts.

After taking the normal and abnormal data for all three sensors, a trial and error procedure was used to determine the sensor thresholds. When the sensor readings exceed the threshold levels, they are considered HIGH. During this procedure, the voltage output of the pressure sensor was monitored for various sorts of actions such as regular touch, pressing, and so on. About 4V analog output was shown at a

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force that might be regarded as harmful, which is roughly 5N force.

The ambient temperature is determined by the temperature sensor. As a person gets closer to the victim's personal space, the temperature around her rises. So, when the temperature surrounding the lady rises suddenly, a temperature sensor is incorporated in such a way that it gets high. When the heart rate exceeds 90 beats per minute, the pulse-rate sensor becomes high.

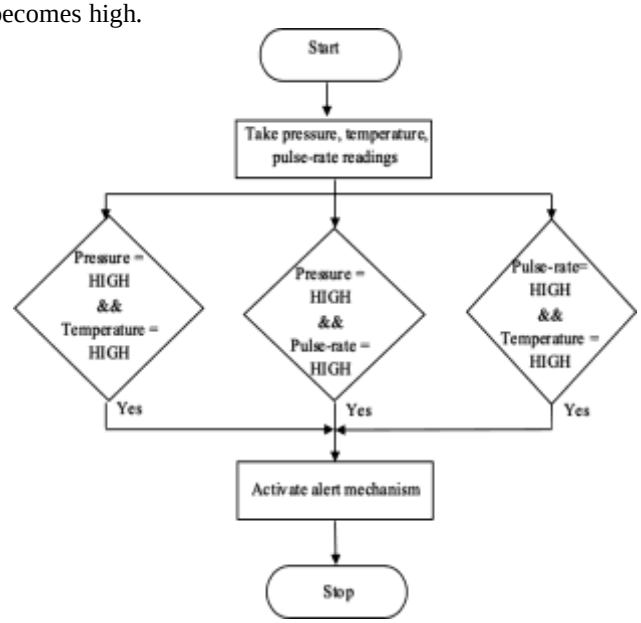

Fig. 11. Flow chart of automated mechanism

E. Alert mechanism

During a dangerous incident, one of the foregoing processes triggers the warning mechanism. When the alarm mechanism is activated, GPS and Node MCU are utilized to send a message to family and officials with the victim's position. For easier access, the location is given as a Google Maps link.

Figure 12 depicts the alert mechanism's system architecture. Whenever the alarm mechanism is activated, the GPS module sends the position coordinates. The GPS receives the satellite's position coordinates. Because these coordinates are difficult to decipher, the location coordinates have been transformed into a Google Maps link for easier access. Following the receipt of the coordinates, a google link containing the victim's location is created. With the use of NODE MCU and software application, this link is delivered to the registered phones.

Fig12.Prototype

III. LITURATURE AND SURVEY

The goal of Islam et al. [1] is to "Design and Implement a Women's Auspice System Using GPS and GSM." In they used a GPS module, three pushbuttons, and a PIC16F887 microprocessor in this setup. To get to the client's location quickly, GPS is used. Three press catches are used to describe the types of mishaps that a victim is likely to face. Any of these three buttons can be pressed if the client encounters any troubles anywhere. The microcontroller will receive it at that point, and an SMS will be sent to a certain phone. The client's location will be tracked until the client saves the framework and switches it off. additionally, they have used to govern the overall framework

"Women Safety Device Designed Using IoT and Machine Learning," Muskan et al. [2] implemented. The goal of this research is to create a device. The device is customised to understand and learn the individual pattern of temperature and heart rate and to determine the threshold when both temperature and heart rate exceed the threshold. When both temperature and heart rate exceed the threshold, it will automatically send SMS and location to an emergency contact number so that action can be taken.

[3] R.S. Yadlapalli et al. This method has offered a bracelet for the safety of women. This device can be activated by pressing a pressure button, which then activates the tear gas and blossoming alarm system for self-defense. When a threat is identified, the device will notify the location to surrounding police or authorities.

Priyadarshini [4] proposed "Women Empowerment for India's Development." Women's fortification is based on empowering every woman in the country to make them self-governing in all aspects as a rule, to be aware of their rights, and to prepare them for physical security. This study focuses on depicting the challenges that women face in their day-to-day lives in India and the Self-Help Group, which is published in the International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181. www.ijert.org is the publisher. Volume 9, Issue 12 Special Issue - 2021 NCCDS - 2021 Conference Proceedings Volume 9, Issue 12 Special Issue - 2021 105 effectively running in the province of Tamil Nadu, ideas on Self Help Group for future improvement, and a contextual examination of Women

D. G. Monisha et al [5]. proposed a system that includes a location tracking mechanism; it works by sending an SOS message with current location to pre-given contacts every 2 minutes if the person in danger presses a single button; if the person presses a button more than once, it records and sends SOS messages and also calls to the pre-set contact numbers when the person presses a button for a long time.

G. C. Hari Kiran et al. [6] proposed and created a smart warble band that is pre-programmed with all human behavior, such as fear, anxiety, and so on, and transfers the observed data to a smartphone linked to the internet. All of these responses are valid.

A. Jesudoss et al. [7] developed a wearable gadget that uses

heartbeat, vibration, and tilt sensors to stimulate the device and relay the position to the family whenever the heartbeat increases.

B. Sathyasri et al. [8] recommended that if a victim is assaulted, she must press the trigger, which activates the device's function and transmits signals to the victim's family.

W. Akram Et Al. [9] instals a gadget, which scans and stores the user's fingerprint. The device is engaged and the fingerprint is scanned every minute when the user starts scanning his or her thumb. When a fingerprint can't be scanned, it's considered illegible.The device sounds the public alert buzzer and broadcasts the position of the device to the cops.

According to S. A. More's research [10],

A mobile app can identify the probability of an emergency and alert family and friends.

[11] demonstrates how to employ image processing to detect any potential threat and provides a choice of defense solutions.

When the emergency button was pressed, the developers of [12] constructed a device that employed a PIC16F876A microcontroller and a SIM808 module with GPS, GSM, and GPRS capabilities to warn friends and family.

[13] develops a technique based on facial traits.

If the facial expression appears to be menacing, a complaint is filed.

[14] optimizes GSM and GPS to provide a secure gadget. The message, which comprises the victim's body position as well as her location, is sent to pre-stored cellphone numbers in this system. Bluetooth connections that are synced are used.

[15] It allows users to segregate the android application from the arm device's triggering. The collected audio and video, as well as the location, are sent to the phone numbers that have been pre-set in the App in the form of a call and a message to notify them.

In [16], an android app is made that offers the geolocation of the female in danger by delivering phoney phone calls, video forwarding, location, and first-aid information, among other features.

[17] employs a secure security gadget that comprises an ATMEGA8 controller with Arduino tool and smart sensors to monitor body tremors, heart rate, and body temperature.

[18] used three sensors: a heartbeat sensor, a temperature sensor, and an accelerometer. These sensors are used and tuned in a variety of applications. In order to detect any anomalies, a notification is sent to loved ones by GPS and text message.

[19] N. Penchalaiah et al. When a message or a call is sent, a warble security device is activated, and a voice command mechanism is used to activate the device and deliver the message.

[20] Dhiraj Sunehra et al. A Wearable Device for Women's Security Has Been Included. A Panic Button Alert will activate the device, after which a camera will be enabled and the location will be sent.

Md.Imtiaz Hanif and Others [21] It has a gadget that may be triggered in two ways: a single press announces the location, and a double press announces the location. Using gsm as a mode of communication. A call to the emergency alert contacts will be made if you push the button for an extended period of time.

We learned from the literature that many efforts have been made to safeguard women's safety by offering various IoT and Application-based devices [22].

A.Z.M. Tahmidul et al. [23] presented a wearable device based on an application. This device's major function is to send SMS and the victim's current location to the nearest police station and family members. The map in the application interface is created in such a way that it suggests a safe area to avoid being attacked by criminals. For rural women, this gadget is difficult to use. Many rural females are unfamiliar with mobile applications, and others may even lack access to a smartphone. However, the size of this equipment makes it difficult to transport.

Another research [24] presented a smart mobile application called "BONITAA" to help rape victims escape being raped. It included capabilities including SMS and location sending through GSM, health and medical support, counselling, and self-defense instructions. To address the issue of rural women, they incorporated the "Bangla" language into their software and attempted to make it user-friendly. The issue is that women who are unfamiliar with mobile applications may not appreciate the features of those programs.

The author also proposed a women's safety device in the publication [25]. The device may also transmit SMS and GPS information to pre-programmed phone numbers. The authors included three push-buttons to prevent sexual manipulation. GSM, GPS, RFID (Radio-Frequency Identification), vibrator, buzzer, and Microcontroller-based display The biggest issue is that their prototype model is too heavy to transport. In addition, the device has three switches that are extremely difficult to navigate in a panic scenario.

U. Rai et al. [26] created a safety device with a GPS module and a push button using a RaspberryPi. When a female touches the push button, a GPS module transmits the device's longitude and latitude. They also created a location finding software to track down the victim's position. The prototype is straightforward, however it is somewhat huge. To capture the location's coordinates, Raspberry-Pi requires an always-on internet connection.

A Raspberry-Pi-based IoT device was also proposed by N. R. Sogi et al. [27]. They named their device "SMARISA," which stands for "smart ring for women's safety." The device also has a camera module and can broadcast the location. The device is engaged when a woman touches the button, and the camera module photographs the occurrence,

uploads the images to the local-host server, and generates sound with the buzzer. They also created a smartphone app for communicating with the victim's valued companion.
Those devices' form factors are also too bulky to transport.
Another device [28] was created to assist victims of teasers and molesters. The device also communicates the victim's SMS and current location to his or her family members. Sensor-based devices are inefficient to utilise due to the creation of defect results.
T. Sen et al. [29] used Raspberry-Pi to create a women's safety device. With its camera module nerve simulator, the device has a majestic architecture. The device's GPS and GSM module can send the victim's location. In order to maximize women's security, the authors also created an Android application and a local server. The issue, however, is that the equipment is too large to be carried out simply.
The problem of this device is that no GSM module was not considered, and costly to develop such devices. Moreover, "Raspberry-Pi", a mini-computer, is also power-hungry. Various sensors, such as pulse rate, motion, and temperature sensor, etc. are used in [30], [31], [32]
V. Sharma et al. [33] also developed a smart shoe to ensure women's safety. The authors used Raspberry-Pi and ArduinoUno Microcontrollers to implement their system. First of all, a shoe base video capturing devices are not efficient to capture correct frames. Besides, the use of Arduino Microcontroller rather than Raspberry-Pi is inadequate in this case. Also, the shock generation of 400KV can kill a human within some minutes.
M. R. Ruman et al. [34] also created a gadget to protect ladies. The device can also send the victim's position so that they can be rescued sooner. A shock generator is also included in the device. The prototype is too large to transport due to the integration of different auxiliary facilities.
A smart band safety device [35] that is activated by double-tapping the screen. It broadcasts the GPS location to pre-defined contacts and police control rooms once triggered. It also has a pulse rate sensor and a temperature sensor for measuring the person's pulse rate and body temperature. When the device is hurled, the force sensor activates and provides the victim's current location. A Piezo buzzer siren is also triggered. The two metal spikes on the band screen's top release electric current, causing shock.
Suraksha [36] is a self-contained gadget that may be activated via speech, switch, or shock/force. The victim's voice is heard. It will be recognised by the gadget, which will automatically send distress signals. The switch is a basic on/off trigger, and shock/force—every time this device is hurled, it will use the force sensor to begin functioning by informing the victim's family and friends of her position.
Poonam et al. [37] created a safety device that runs on an ATmega 328 microcontroller without the need for an Android app, making it a stand-alone device. It employs GPS and GSM modules to follow the woman's location and then sends the information to her family and friends, informing them of her present location.
Many researchers have been interested in real-time tracking, and a lot of study has been done on tracking systems [38]. In the International Journal of Industrial Electronics and Electrical Engineering, G.Bharathi and L. Ramurthy from Vemu Institute of Technology suggested "Children Tracking System Using Arm7 Microcontroller" in 2014. It was a very primitive system that could simply provide the user's location through GSM.

IV.CONCLUSION

The major goal of creating a woman safety device is to function as a rescue and prevent any harm to women in the case of a hazard. A smart device for women's safety is built using the suggested approach, which automates the emergency alarm system. This device recognizes and sends notifications to loved ones with the women's position coordinates without requiring her input in emergency situations. It instantly sends an emergency message to the family members and the nearest police station.
The prototype may be carried in a variety of bags, including purses and laptop bags. It is recommended that the prototype be carried in these bags since the person attempting to hurt may not discover the device within the bag. This prototype may be transformed into wearables like smartwatches, bracelets, and necklaces through the customization process. The key benefit of our suggested system is that it includes both automatic and manual mechanisms.
It is also cost-effective and simple to use When the alarm is received, the suggested system can be enhanced with features such as recording audio and video of the culprit when the mechanism is activated which can be produced as a piece of evidence in the court.

V. REFERENCE

[1]. Auspice System by Utilizing GPS and GSM", International Conference on Electrical, Computer and Communication Engineering (ECCE), 2019, pp. 1-5.
[2]. G C Harikiran, Karthik Menasinkai, Suhas Shirol, "Smart Security Solution for women based on Internet Of Things(IOT)", International Conference on Electrical, Electronics, and Optimization Technique IEEE-2016.
[3]. R. S. Yadlapalli, V. P. Rama Lakshmi, T. K. and A. Miriyala, "SMART INTELLIGENT SECURITY SYSTEM FOR WOMEN," International Journal of Electronics and Communication Engineering & Technology (IJECET), vol. 7, no. 2, p. 41–46, April 2016.
[4]. Divya Chitkara, Nipun Sachdeva ; Yash Dev Vashisht, "Design of a women safety device", 2017 IEEE.

[5]. A.P. Thaware, "Safety device for women's security using GSM/GPS", International Journal on Recent and innovation trends in computing and communication, vol.5, issue.4,5-7, 2017

[6]. G. C. Harikiran, K. Menasinka and S. Shirol, "Smart security solution for women based on Internet Of Things(IoT)," International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT),

[7]. A. Jesudoss, N. Y. and S. R. T, "SMART SOLUTION FOR WOMEN SAFETY USING IoT," International Journal of Pure and Applied Mathematics, vol. 119, no. 12, pp. 43-49, 2018.

[8]. B. Sathyasri, J. V. U, J. S. G. V. K., and P. T, "Design and Implementation of Women Safety system Based On IoT Technology," International Journal of Recent Technology and Engineering (IJRTE), vol. 7, no. 6S3, pp. 177-181, April, 2019.

[9]. W. Akram, M. Jain and H. C. Sweetlin, "Design of a Smart Safety Device for Women using IoT," INTERNATIONAL CONFERENCE ON RECENT TRENDS IN ADVANCED COMPUTING (ICRTAC), vol. 165, pp. 656-662, 2019.

[10]. S. A. More, R. D. Borate, S. T. Dardige, S. S. Salekar, Prof. D. S. Gogawale " Smart Band for Women Security Based on Internet of Things (IOT)" International Journal of Advance Research in Science and Engineering, Volume No s6,Issue No. 11, November 2017

[11]. Mohamad Zikriya, Parmeshwar M G, Shanmukayya R Math, Shraddha Tankasali, Dr. Jayashree D Mallapur "Smart Device for Women Safety using IoT (Internet of Things)" International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, NCESC - 2018 Conference Proceedings

[12]. Naeemul Islam , Md. Anisuzzaman , Sikder Sunbeam Islam , Mohammed Rabiul Hossain , Abu Jafar Mohammad Obaidullah " Design and Implementation of Women Auspice System by Utilizing GPS and GSM". 2019 International Conference on Electrical, Computer and Communication Engineering (ECCE), 7 -9 February, 2019

[13]. Remya George, AnjalyCherian.V, Annet Antony, Harsha Sebestian, Mishal Antony, Rosemary Babu.T " An Intelligent Security System for Violence against Women in Public Places ". International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958,Volume-3, Issue-4, April 2014

[14]. B.Vijaylashmi, Renuka.S, Pooja Chennur, Sharangowda.Patil " Self[3] B.Vijaylashmi, Renuka.S, Pooja Chennur, Sharangowda.Patil " Self defence system for women safety with location Tracking and SMS alerting through GSM network". IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308

[15]. D. G. Monisha, M. Monisha, G. Pavithra, and R. Subhashini," Women Safety Device and Application-FEMME". Vol 9(10), Issue March 2016

[16]. Dr. Sridhar Mandapati, Sravya Pamidi, Sriharitha Ambati," A Mobile- based Women Safety Application (I Safe App)". Vol 17, Issue 1, Ver. I (Jan – Feb. 2015)

[17]. Deepak Sharma, Abhijit Paradkar "All in one Intelligent Safety System for Women Security". Vol 130 No.11 November 2015.

[18]. Prof. R.A. Jain, Aditya Patil, Prasenjeet Nikam, Shubham More, Saurabh Totewar," Women's safety using IOT ". Vol: 04 Issue: 05| May-2017

[19]. N. Penchalaiah, . S. M, V. K. . R. C, . P. K. R. D. V and. S. D, "An IoT Based Smart Wearable Device for Women Safety," Special Issue of First International Conference on Information Technology, Computing &Applications (ICITCA), vol. 03, no. 05S, pp. 89-95, 2021.

[20]. D. Sunehra, S. S. V, S. V and U. K. G. B "Raspberry Pi Based Smart Wearable Device for Women Safety using GPS and GSM Technology," 2020 IEEE International Conference for Innovation in Technology (INOCON), no. 20307416, 2020.

[21]. M. I. Hanif, A. Shakil, and A. Wahiduzzaman , "AntiMolestation: An IoT based Device for Women's SelfSecurity System to Avoid Unlawful Activities," (IJACSA) International Journal of Advanced Computer Science and Applications, vol. 11, no. 11, pp. 722-727, 2020.

[22]. R. Ramachandiran, L. Dhanya, and M. Shalini, "A survey on women safety device using IoT," 2019 IEEE Int. Conf. Syst. Comput. Autom. Networking, ICSCAN, 2019, pp. 1–6, 2019, DOI: 10.1109/ICSCAN.2019.8878817.

[23]. A. Z. M. Tahmidul Kabir, A. M. Mizan, and T. Tasneem, "Safety Solution for Women Using Smart Band and CWS App," pp. 566–569, 2020, DOI: 10.1109/ecti-con49241.2020.9158134.

[24]. S. R. Mahmud, S. N. Tumpa, A. B. Islam, C. N. Ferdous, N. Paul, and T. T. Anannya, "BONITAA: A smart approach to support the female rape victims," 5th IEEE Reg. 10 Humanit. Technol. Conf. 2017, R10-HTC, 2017, vol. 2018-January, pp. 730–733, 2018, DOI: 10.1109/R10- HTC.2017.8289061.

[25]. S. Priyanka, Shivashankar, K. P. Roshini, S. P. Reddy, and K. Rakesh, "Design and implementation of SALVUS women safety device," 2018 3rd IEEE Int. Conf. Recent Trends Electron. Inf. Commun. Technol. RTEICT 2018 - Proc., pp. 2438–2442, 2018, DOI: 10.1109/RTEICT42901.2018.9012442.

[26]. [26]-U. Rai, K. Miglani, A. Saha, B. Sahoo, and M. Vergin Raja Sarobin, "ReachOut Smart Safety Device," 2018 6th Ed. Int. Conf. Wirel. Networks Embed. Syst. WECON 2018 - Proc., pp. 131–134, 2018, DOI: 10.1109/WECON.2018.8782071.

[27]. N. R. Sogi, P. Chatterjee, U. Nethra, and V. Suma, "SMARISA: A Raspberry Pi Based Smart Ring for Women Safety Using IoT," Proc. Int. Conf. Inven. Res. Comput. Appl. ICIRCA, 2018, no. Icirca, pp. 451–454, 2018, DOI: 10.1109/ICIRCA.2018.8597424.

[28]. S. K. Punjabi, S. Chaure, U. Ravale, and D. Reddy, "Smart Intelligent System for Women and Child Security," 2018 IEEE 9th Annu. Inf. Technol. Electron. Mob. Commun. Conf. IEMCON, 2018, no. Apr 9600, pp. 451–454, 2019, DOI: 10.1109/IEMCON.2018.8614929.

[29]. T. Sen, A. Dutta, S. Singh, and V. N. Kumar, "ProTecht - Implementation of an IoT based 3 -Way Women Safety Device," Proc. 3rd Int. Conf. Electron. Commun. Aerosp. Technol. ICECA, 2019, pp. 1377–1384, 2019, DOI: 10.1109/ICECA.2019.8821913.

[30]. K. Thamaraiselvi, S. Rinesh, L. Ramaparvathy, and V. Karthick, "Internet of Things (IOT) based smart band to ensure the security for women," Proc. 2nd Int. Conf. Smart Syst. Inven. Technol. ICSSIT 2019, no. Icssit, pp. 1093–1096, 2019, DOI: 10.1109/ICSSIT46314.2019.8987928.

[31]. M. R. Tejonidhi, Aishwarya, K. Chaithra, M. K. Dayana, and H. Nagamma, "IoT Based Smart Security Device for Women's Safety," 1st IEEE Int. Conf. Adv. Inf. Technol. ICAIT 2019 - Proc., pp. 348–352, 2019, DOI: 10.1109/ICAIT47043.2019.8987242.

[32]. [32]-V. Hyndavi, N. S. Nikhita, and S. Rakesh," Smart Wearable Device for Women Safety Using IoT," no. Icces, pp. 459–463, 2020, DOI: 10.1109/icces48766.2020.9138047.

[33]. V. Sharma, Y. Tomar, and D. Vydeki, "Smart Shoe for Women Safety," 2019 IEEE 10th Int. Conf. Aware. Sci. Technol. iCAST 2019 - Proc., pp. 1–4, 2019, DOI: 10.1109/ICAwST.2019.8923204.

[34]. M. R. Ruman, J. K. Badhon and S. Saha, "Safety Assistant And Harassment Prevention For Women," 2019 5th International Conference on Advances in Electrical Engineering (ICAEE), Dhaka, Bangladesh, 2019, pp. 346-350, DOI: 10.1109/ICAEE48663.2019.8975648.

[35]. Ahir, S., Kapadia, S., Chauhan, J., & Sanghavi, N. (2018, January). The Personal Stun-A Smart Device For Women's Safety. In 2018 International Conference on Smart City and Emerging Technology (ICSCET) (pp. 1-3). IEEE.

[36]. Bhardwaj, N., &Aggarwal, N. (2014). Design and Development of "Suraksha"-A Women Safety Device. International Journal of Information & Computational Technology, 4(8), 787-792.

[37]. PoonamBhilare, AkshayMohite, DhanashriKamble, SwapnilMakode and RasikaKahane,"Women Employee Security System using GPS And GSM Based Vehicle Tracking", Department of Computer Engineering Vishwakarma IOT SavitribaiPhule Pune University India, E-ISSN:-2349- 7610 INTERNATIONAL JOURNAL FOR RESEARCH IN EMERGING SCIENCE AND TECHNOLOGY,Volume-2, ISSUE-1, JAN-2015

[38]. G.Bharathi, L. Ramurthy, Children Tracking System Using Arm7 Microcontroller, conference paper in International Journal of Industrial Electronics and Electrical Engineering, Dec 2014, vol. 2.