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ENHANCED WEARABLE STRAP FOR FEMININE USING IoT

SATHISH KUMAR, S. NANDHINI, R. SUJITHA

Department of Computer Science and Engineering, Manakula Vinayagar Institute of Technology, India
*Corresponding Email: sathishmail8@gmail.com

ABSTRACTS

Women are increasingly experiencing a slew of security difficulties while traveling alone at night, particularly in the IT industry. Despite the benefits of new technologies, the rate of crime against women continues to rise. Even though numerous security gadgets are available on the market, women are unaware of them and do not use them. We are going to develop a prototype design using IoT. The term "physical objects" that are outfitted with sensors, computing power, software, and other technologies that enable them to connect and exchange data with other devices and systems over the Internet or other communication networks are referred to as the Internet of Things. Our project's goal is to give protection to working women and children. Most crimes occur as a result of a person's lack of awareness. We plan to keep the person aware throughout by administering a VIBRATION. The device comprises components such as the Start button, Arduino UNO, Panic Button, GSM Neo 6 m, GPS, Pulse Sensor, Vibration Motor, 6V Transformer, and Touch Sensor. The current location is determined using GPRS and GSM Neo 6 m. In emergency cases, a Pulse Sensor detects the person's actual pulse rate. The person must use a Touch Sensor to stop the vibration. If the vibration does not stop within the specified time, it is assumed that the person is not in an active state. The Emergency alert is then sent to the predefined contacts stored on the Arduino board. The transformer with a voltage range of

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6v supplies power to the entire device. The future scope of this project is we can collect datasets of all hospitals for emergency purpose, creating offline maps to locate the victim without internet connection. Then the device can also contain Mic and camera to live monitor the consequences.

1. INTRODUCTION

In terms of women's security, we are most likely living in the darkest period in our contemporary society's history. We want to make women feel as powerful as they have always been, strong enough to combat the parasites of our society, strong enough to overcome obstacles, and strong enough to protect themselves from sexual attacks. We want to empower those who are essential to our survival. Our goal is to create a system that will make every location and hour safer for women once again. A mechanism that will restore humanity's communal nature. With a single touch of a button, this technology will geotag and send an SOS alert to the local police station, close contacts, and anyone in and around the crime scene. The goal is to compensate for the time it takes the cops to get at the scene. Most of the incidents were happened in public places especially at train station, market, public gathering etc. The below fig.1 explains the pie chart which implies the percentage of incidents happened in public places.

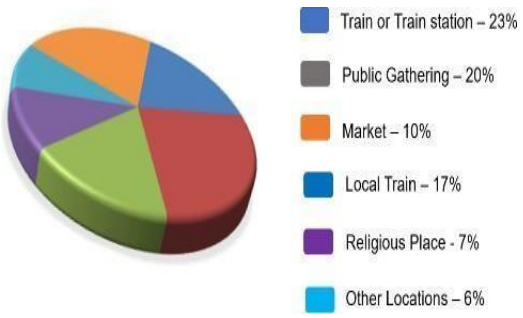

Fig. 1. Percentage of Incidents happened in Public Places

The percentage of cases happened in different countries where Thailand has the highest percentage that women has suffered physical assault compared to other countries like United Kingdom, Brazil, India. The fig.2 bar chart represents the percentage of physical assault faced by women in different countries

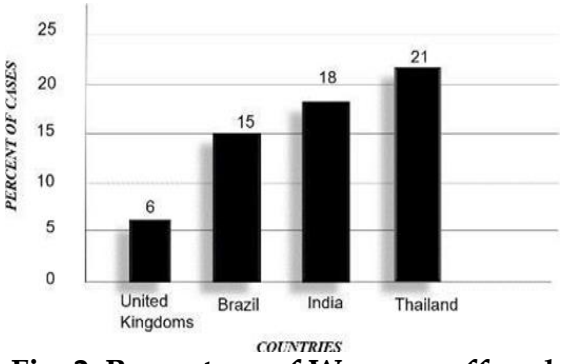

Fig. 2. Percentage of Women suffered Physical Assaults

According to the survey the percentage of cases increases in last five years especially women between the age 18-24 faced many consequences like harassment, So

the below fig.3 shows the bar chart with percentage of cases and different ages of women who faced the harassment.

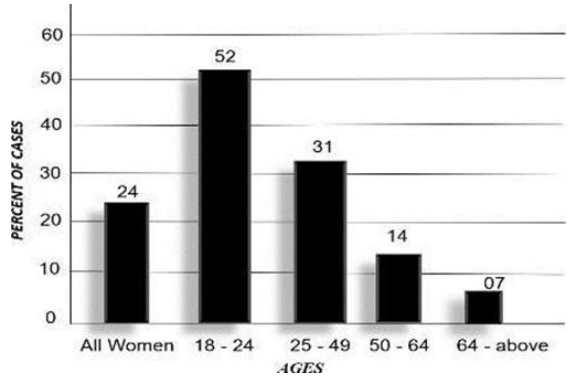

Fig. 3. Most 18 – 24 Years Women has been Harassed in Public Places in Last Five Years

2. LITERATURE SURVEY

"Smart Wearable Device for Women Safety Using IoT": V. Hyndavi, N. Sai Nikhita, S. Rakesh – 2021. Any woman must touch that push button if she feels insecure or in danger. The victim's image will then be simultaneously taken and saved on this Raspberry Pi operating system (OS). Then, the previously saved OS image will be taken out automatically because adding more photographs can increase storage (Hyndavi et al., 2020).

"Design and Development of an Advanced Affordable Wearable Safety Device for Women": Freedom Against Fearsome": Israt Humaira, Kazi Arman Ahmed, Sayantee Roy, Zareen Tasnim Safa, F. M. Tanvir Hasan Raian , Md. Ashrafuzzaman – 2021. This device is simple in design, affordable, and practicable. By providing a hidden camera, GPS and GSM module, shocking device, and voice recognizer, our products "BOHNNI" and "BADHON" will ensure a safe atmosphere for women and children in any scenarios. There are already a variety of health and activity monitoring sensor belts on the market, but the design of an integrated safety device is fundamentally different since very accurate calculations and designs are required (Humaira et al., 2021).

"IoT based wearable device to monitor the signs of quarantined remote patients of COVID-19": Nizar Al Bassam, Shaik Asif Hussain, Ammar Al Qaraghuli ,Jibreal Khan , E.P. Sumesh, Vidhya Lavanya – 2021.Internet of things (IoT) technology have enabled remote health monitoring systems to use, accessible, and handy for measuring and recording patient parameters in a comfortable setting. The proposed IoT-based health monitoring system can measure physiological parameters and health symptoms in COVID-19-affected patients and transmitting those data to an Application Peripheral Interface (API), which serves as a database for browsing and monitoring the infection level (Bassam et al., 2021).

"Women Self Defense Device": Jayashree Agarkhed, Aishwarya Rathi, Maheshwari, Faqarunnisa Begum – 2021. Our main intention in the current circumstance is: "Women should always feel free to roam; A camera and a voice recognition module may also be installed in a watch so that it catches and records all of the photos and voice said by the victim, which are then delivered to the registered numbers and saved immediately (Agarkhed et al., 2020).

"Smart Security Device for Women Based on IoT Using Raspberry Pi" Prottasha Ghosh, TanjimMasroor Bhuiyan, Muhib Ashraf Nibir , Md. Emran Hasan , Md. Rabiul Islam , Md. Rokib Hasan , Tanvir Hossain – 2021. This gadget may be changed with a clever and effective one,

as security is a big issue for any woman in today's environment. For the first time, this sort of gadget has been used to capture direct evidence and store it on the web for later use (Ghosh et al., 2021).

"IoT based Unified approach for Women safety alert using GSM": Venkatesh. K, Parthiban. S, Santhosh Kumar. P, Vinoth Kumar.C.N. S: - 2021. The goal of this project is to ensure that every lady in our general population believes that everything in the world is OK and secure. According to a survey in India, 53 out of 100 working women do not believe that everything is OK in the world - women are working at night. Women experiencing barriers are also prevalent in Delhi, Mumbai, Hyderabad,Kolkata, and Pune, according to a survey of 86 working women in India (Venkatesh et al., 2021).

"Arduino Based Smart Shoe System for Women Safety, Defense and Integrated Intelligent Tracking": Syed Mosharaf Hossain, Subhendu Chakraborty – 2021. This smart safety shoe for ladies is a ready-to-wear gadget for women's everyday use. To the best of the writers' knowledge, there is no such off-the-shelf, ready-to use equipment that can be utilised by women for safety purposes. There is no need for a complicated charging circuit with this gadget, and no wires can be seen from the exterior. The main purpose of this project was to create a ready-to-use and portable smart ladies' safety gadget (Hossain et al., 2021).

"IOT Based Women SecurityA Contemplation":Deepinder Kaur, RavitaChahar, Jatinder Ashta – 2020. In comparison to mobile applications, pre-programmed smart hardware devices can perform efficiently in danger circumstances. In the future, a new device can be designed for women who use public transportation in which the female and driver must give biometric impressions before beginning the trip and information of both is used by GPS in case of an unfortunate event, regardless of whether the passenger has a smart phone or not (Kaur et al., 2020).

"Smart Safety and Security Solution for Women using kNN Algorithm and IoT":Bysani Sai Yaswanth, Darshan R S, Pavan H, Srinivasa D B, B T Venkatesh Murthy – 2020. This study focuses on an IoT-based self-security system that is comfortable, easy to use, and wearable, and that assists in sharing the user's position when they are panicked,as well as locating the closest safe area. The user's position is sent into the machine learning system, which then forecasts the location of the nearest safe spot (Yaswanth et al., 2020).

"Lifecraft: anAndroid Based Application System for Women Safety":Rabbina RidanKhandoker, Shahreen Khondaker, Fatiha-Tus-Sazia, FernazNarin Nur, Shaheena Sultana – 2019.This study presents a new model of women's safety that attempts to create a particularly safe environment for women. This study compares the essential requirements of an intelligent security system with technological demand and system construction problems. It may beemployed in a variety of situations, including sexual problems, accidents, hijackings, and public attacks (Khandoker et al., 2019).

"ProTecht – Implementation of an IoT based 3 –Way Women Safety Device": Trisha Sen, Arpita Dutta, Shubham Singh,VaegaeNveen Kumar – 2019. The IoT-based 3-Way Women's Safety Device accomplishes its goal by offering users

with a self-defense mechanism as well as facilities for collecting information and recording evidence. When the user says the words "EMERGENCY" in the Android app, the savedemergency contacts receive a message and a call, as well as the user's current position. The gadget responds quickly and may assist the user in remaining safe in any situation (Sen et al., 2019).

"SMARISA: A Raspberry Pi based Smart Ring for Women Safety Using IoT"Navya R Sogi, Priya Chatterjee, Nethra U, Suma V – 2018. This report proposed a method through which a woman can immediately notify the appropriate authorities if she is in danger. The suggested method obtains the device's coordinates by using GPS tracking of the smart phone. This method also uses the image's URL and an alert message to notify the family and police officers (Sogi et al., 2018).

"B with U- IoT based Woman Security System": Akhila C M, Jisna Raju, Lakshmi Sethunath, Vishnu Prasad Yadav, Mrs. Manju Bravada's – 2019. We have now created a project that will address crucial concerns that women confront in today's society and give them the strength to fight back. It includes a band prototype, shock shoe, and mobile device that displays the current location on a Google map as well as live streaming on the internet (Akhila et al., 2019).

"Design of a Smart Safety Device for Women using IoT": Wasim Akram, Mohit Jain, C. SweetlinHemalatha - 2019. This proposes a solution that will attempt to address the shortcomings of the current system while also ensuring women's false proof safety. Safe spots from the victim's present position will be shown on the map so that women may reach the safe place from their current location, according to a smartphone app created for women's protection (Akram et al., 2019).

"The Personal Stun- A Smart Device for Women's Safety": Shivani Ahir, Smit Kapadia, Prof. Jigar Chauhan, Prof. Nidhi Sanghavi – 2018. They concentrated on creating a smart bracelet that can be triggered by tapping the screen twice. The pulse sensor is an integrated sensor in the gadget that detects the person's pulse rate. The gadget now has a force sensor that activates when it is thrown with force. On the Android platform, a smart application will be built that connects to the device through Bluetooth interface and displays the subject's detected data to the ICE contacts (Ahir et al., 2018).

"SafeBand: A Wearable Device for the Safety of Women in Bangladesh": Muhammad Nazrul Islam, Nuzhat Tabassum Promi, Jannatul Maowa Shaila, Mohoshina Akter Toma, Maria Afnan Pushpo, Fatema Binte Alam ,Syeda Nusraht Khaledur, Tasmiah Tamzid Anannya, Md. Fazle Rabbi – 2018. The 'Safe Band' system's assessment research revealed that the system efficiently executed all the capabilities and had a very good usability quality. In the future, it is planned to merge the entire gadget onto a single mini chip for real-world application, making transporting the system more efficient for women (Islam et al., 2018).

"Design and Development of an IOT based wearable device for the Safety and Security of women and girl children": AnandJatti, MadhviKannan, Alisha RM, Vijayalakshmi P, ShresthaSinha - 2018.

They focused on using the Internet of Things in conjunction with wearable devices to ensure the protection and security of women and girls. Body position is estimated using raw accelerometer data from a triple axis accelerometer (Jatti et al., 2016).

3. OBJECTIVE OF THE RESEARCH

Women are not safe anywhere and are most vulnerable when traveling alone into lonely roads and deserted places, so our purpose of effort is to reduce or overcome the rate of crime against women. The development of SMART BAND for women safety is to keep the victim safe from the danger. When a woman or a child feels threatened, she must activate the device by pressing the Start Button. After activating the device, press the panic button to send the message "HELP" along with the current location to the predefined contacts via GSM Neo 6m and GPRS. At the same time, the Pulse Sensor detects the person's pulse rate. When the live location is sent, the person's pulse rate is also sent. In addition to this we have placed VIBRATION MOTOR to always keep the person alert. The Vibration Motor is placed to always keep the person alert. When in the active state, the person must use the reset button to stop the vibration. If the vibration motor is not stopped within a certain period, assuming the person is not conscious, an emergency alert is sent to the predefined contacts with the subject "EMERGENCY". The device receives power from the transformer ranges of 6v.

4. EXISTING WORK

When women are traveling alone or in a distant region where they cannot acquire help or appropriate assistance, they are attacked (Sogi et al., 2018). This research proposes an Internet of Things-based solution to the problem of women's safety that overcomes present technological restrictions. When a woman is in danger, the proposed design incorporates mechanisms that warn family members and a nearby police station so that help may be sent quickly. A shock waves generator is also included in the suggested design, which women may use to assault the perpetrator. Some of the other components of the projected work that give further assistance to women are as follows:

1. Sending group SMS with the device and the victims' phones.
2. The victim's voice is recorded and later used as evidence against the offender.
3. Locating a safe spot on a map from where the victim is now.

5. DESIGN OF THE EXISTING WORK

The suggested women's safety device supports a woman who is in a potentially perilous situation. The device is practically ready for everything that might go against the woman's wishes. An At mega 328 microcontroller oversees it. The gadget is activated by a fingerprint scanner, a GSM (Global System for Mobile Communications) module transmits alarm messages, a buzzer warns the environment, and a shock wave generator is utilized for self-defence. On an LCD, the message is shown. The following fig.4 explains how the gadget works: The woman's fingerprint must first be registered before the device can be activated. The gadget continues scanning the woman's fingerprint every minute as soon as she

turns it on. The gadget will be activated if the scanner finds no fingerprint, blowing a bell to alert the public nearby. Because it only scans the woman's fingerprint in an emergency, i.e., when she detects a threat, the device's quality is unaffected. The GPS data is also relayed to the LCD and the GSM modem, which will deliver the message to the woman's relatives and friends (Sogi et al., 2018).

Even if she is pulled down from behind and is unable to activate an alarm, the device will send an emergency message to all the woman's ICE contacts (In Case of Emergency Contacts) alerting them to her current position. The design also includes a shock wave generator that may be used as a weapon or to assist the lady in self-defence. A shock wave generator's gear, which comprises a switch, transformer, and wires. One of the two free ends of the wires acts as the high voltage source, while the other serves as the return path's ground. The high voltage cannot arc unless it comes into touch with the attacker's body, which acts as a conducting conduit between the two ends because the loose ends are not in direct contact. The circuit has three important stages.

- The oscillator
- The voltage amplifier
- The power supply

When the battery is fully charged, the voltage is delivered to the oscillator stage. The transformer serves as an inverter, increasing the frequency of oscillation. The output of the transformer is then delivered to the capacitors, which hold the current until it is utilized to electrocute the aggressor. In the existing work, they have added some features which supports through android application, and it is represented in the below fig.5.

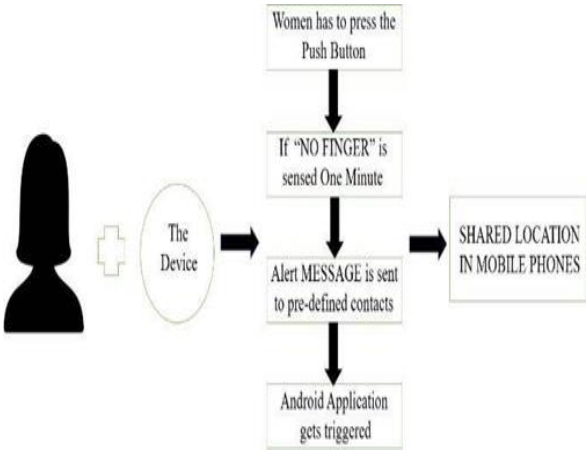

Fig. 4. Workflow of the Proposed Design

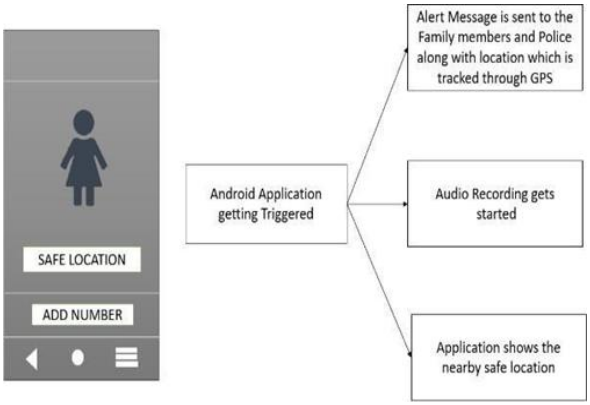

Fig. 5. Additional Features supported through Android Application

6. PROPOSED WORK

Our suggested smart band project consists of hardware components connected to an Arduino UNO. When the Panic button is pressed, the GPS and GSM module activates, tracking the user's current location and sending a message with the victim's heart rate via the Pulse sensor. Our primary goal is to keep the victim awake. To do this, we provide a Vibration motor for a set period. Once the victim awakens, they can manually switch off the vibration, and if it continues, another alarm

message is sent to the predetermined contact. A switch is used to turn on the device. A push button is triggered to track the location and send message and further processing (See Figs. 6-10).

Module 1: Activating the device and tracing the location using GPS Neo-6m Module.

Module 2: Sending messages to the Predefined Contact.

Module 3: Pulse rate detection of the person.

Module 4: Finding the active state of the person using Vibration Motor.

A) PROPOSED ARCHITECTURE

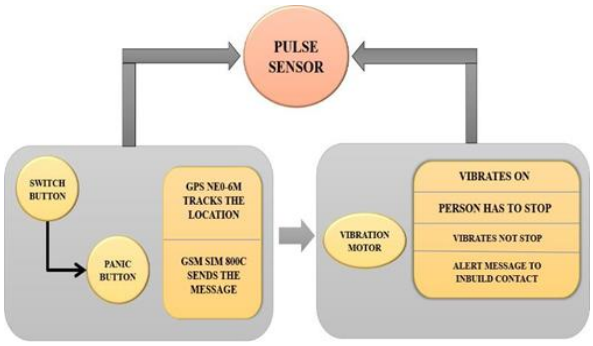

Fig. 6. Architecture diagram

B.) MODULE 1: ACTIVATING THE DEVICE AND TRACING THE LOCATION USING GPS NEO-6M MODULE

Global Positioning System NEO-6M:

Parts Used:

1. Arduino UNO Board
2. NEO - 6M GPS module
3. Jumper wire

CONNECTIONS:

1. First, the RX pin from the GPS module needs to be connected to Arduino Pin 8.
2. The GPS module's TX pin should then be linked to pin 9 on the Arduino.
3. The GPS module's VCC pin should then be linked to the 12V power supply.
4. •The GPS's GND is then linked to the power supply's GND.

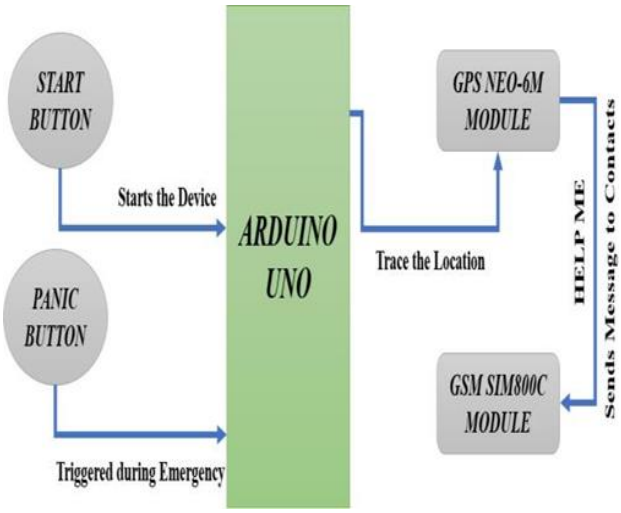

Fig. 7. Diagrammatic view of tracking and sending location

C.) MODULE2: SENDING MESSAGES TO THE PREDEFINED CONTACTS

Global System for Mobile Communication SIM 800C:

Parts Used:

1. Arduino UNO Board
2. SIM
3. Jumper wires

CONNECTIONS:

1. •The SIM card must first be inserted into the SIM 800c in the SIM cardholder.

2. •The Arduino Pin 4 should be linked to the P in the GSM.
3. •The Arduino Pin 3 should be linked to the T in the GSM.

The Panic Button was connected to the VCC. and the Arduino GND was linked by the GND.

D). WORKING DISCRIPTION:

According to the above fig.7, it explains how the GPS and GSM connected with the Arduino. The start switch must first be used to turn on the gadget. The Panic Button must then be held down for 5 seconds. Following the GPS tracking of the current location, the tracked location is communicated via the GSM Module 800c to the designated contacts along with the message "HELP ME."

E). MODULE 3: PULSE RATE DETECTION OF THE PERSON

The Arduino UNO board has a pulse sensor attached to it.

Parts used:

1. Arduino UNO Board
2. Pulse rate Sensor
3. Jumper wires.

CONNECTIONS:

1. The pulse sensor's A0 is linked to the Arduino UNO's A0.
2. The Arduino UNO's GND is connected to the pulse sensor's GND.
3. The pulse sensor's VCC is connected to the start button Fig.8 Code of GSM sending SMS

F). WORKINGS DISCRIPTION:

According to the above fig.8, it explains how GSM is connected to the Arduino and it shows the workflow of how GSM sends messages to the predefined contact. The person's pulse rate is frequently monitored by the pulse sensor. The person's pulse rate is communicated to the designated contacts as soon as the panic button is pressed, coupled with the person's location. The alert message "EMERGENCY NEED HELP" is delivered to the predefined contacts once more if the pulse rate changes to the left or right of the threshold level.

G). MODULE 4: FINDING THE ACTIVE STATE OF THE PERSON USING VIBRATION MOTOR

Parts Used:

1. Vibration Motor
2. Arduino UNO Board
3. Jumper wires

CONNECTIONS:

1. The Arduino UNO's GND and the vibration motor's GND are connected.
2. The Arduino Pin 7 is connected to the VCC of the vibration motor.11 Fig.9 Code of vibration motor

H). WORKING DISCRIPTION:

According to the above fig.9, it explains how vibration motor is connected with the Arduino and it represents how the vibration will function. The vibration motor is preserved to detect a person's active state. In a gap of 30 minutes, it vibrates for 5 seconds. If the person is in an active state, she must press the button to cease the vibration. Say an alert message is sent to the predetermined contacts if the vibration hasn't stopped for a while.

I). OUR PROTOTYPE

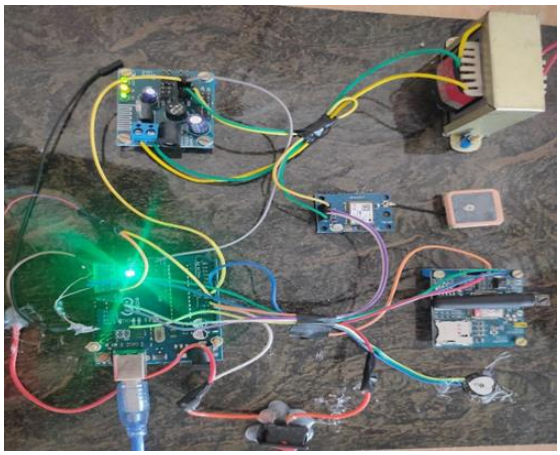

Fig. 8. Our Actual Prototype

J). MESSAGE ALONG WITH THE BPM VALUE

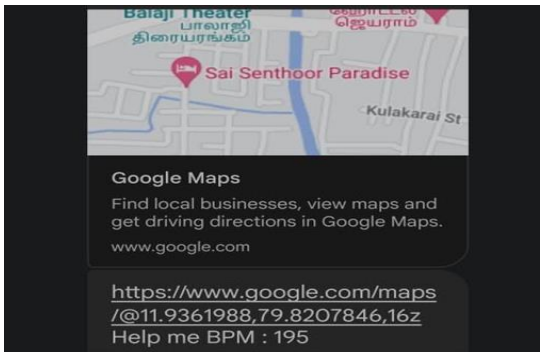

Fig. 9. GPS Location

GPS LOCATION

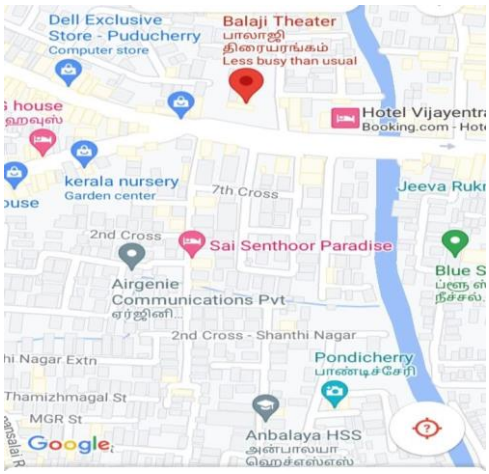

Fig. 10. GPS Location

7. RESULT AND DISCUSSION

A) DEVICE PRICE COMPARISON

We have taken the survey based on price comparison from the existing device and it is described in the below fig.11

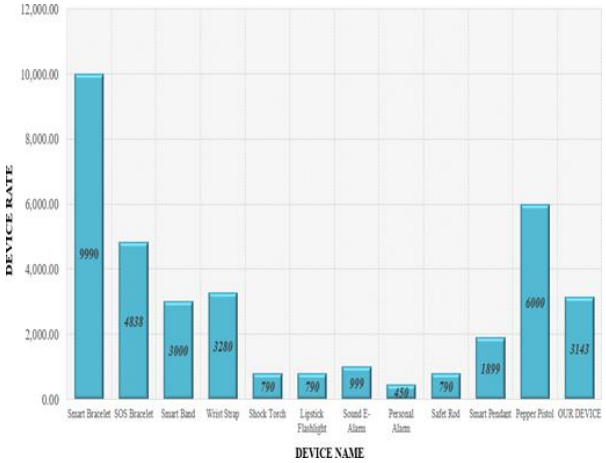

Fig. 11. Based on Cost Comparison

B) PULSE RATE DETECTION

A person pulse rate is detected with the help of pulse sensor. The below bar chart in fig.12 analysis the pulse rate of the person based on their ages and their average BPM is shown.

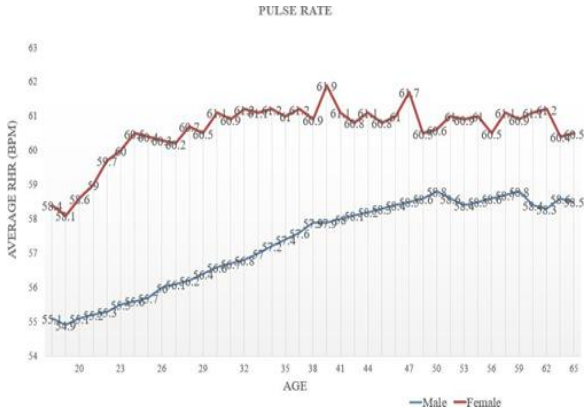

Fig. 12. Pulse Rate Detection level

C) VIBRATION ANALYSIS

The rate of vibration is calculated with the peak values. It represents the peak-to-peak values in the form of waves, according to the period which is shown in the fig. 13.

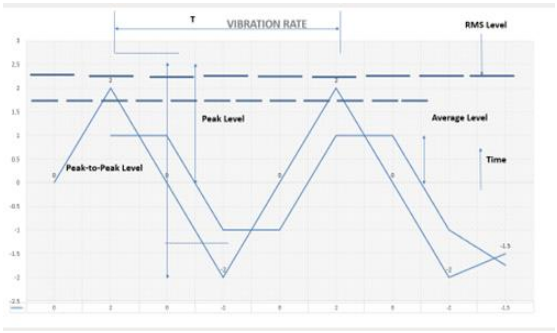

Fig. 13 Vibration Rate level

The actual rate of vibration which was detected by our device is represented in the below fig. 14.

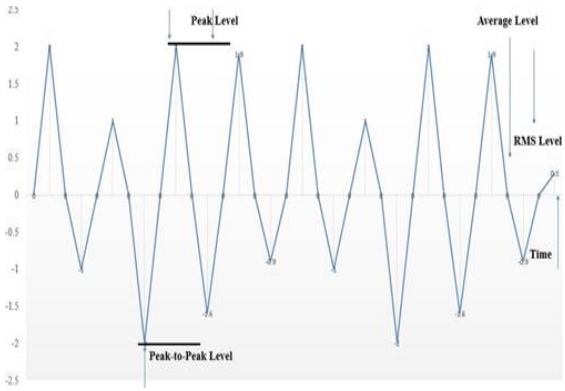

Fig. 14. Vibration Detection Rate

8. CONCLUSION

Our main intention in the current era is that "women should always feel free to roam; wherever; anytime. They should not experience any adverse circumstances of any type. As a result, we created the smart band, which consists of several hardware parts connected to IoT devices. Since the device features a GPS and GSM module, it can track where abouts and send messages to contacts that have been predefined. A vibration motor is also utilized in addition to keeping the sufferer awake for a set amount of time. We believed that the women would benefit greatly from being in difficult situations. This device's future applications will benefit youngsters, physically challenged ladies, and senior citizens. This project can be utilized by parents to find where their children are in addition to enhancing the conditions for women's safety in India. Additionally, we may improve by compiling hospital datasets that will aid the sufferer by using GPS and GSM to follow her location and send signals to the closest hospital when her pulse drops, or she needs an emergency care. We may also create offline maps to locate the victim even when there is no signal or internet connection. We can also include camera and microphone in addition to live monitor the activities when need.

REFERENCES

Agarkhed, J., Rathi, A., & Begum, F. (2020, October). Women Self Defense Device. In *2020 IEEE Bangalore Humanitarian Technology Conference (B-HTC)* (pp. 1-5). IEEE.

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.

Akhila, C. M., Raju, J., Sethunath, L., Yadav, V. P., & Bhavadas, M. M. (2019). B with U-IoT based Woman Security System. *vol*, *8*, 507-509.

Akram, W., Jain, M., & Hemalatha, C. S. (2019). Design of a smart safety device for women using IoT. *Procedia Computer Science*, *165*, 656-662.

Al Bassam, N., Hussain, S. A., Al Qaraghuli, A., Khan, J., Sumesh, E. P., & Lavanya, V. (2021). IoT based wearable device to monitor the signs of quarantined remote patients of COVID-19. *Informatics in medicine unlocked*, *24*, 100588.

Ghosh, P., Bhuiyan, T. M., Nibir, M. A., Hasan, M. E., Islam, M. R., Hasan, M. R., & Hossain, T. (2021, January). Smart Security Device for Women Based on IoT Using Raspberry Pi. In *2021 2nd International Conference on Robotics, Electrical and Signal Processing Techniques (ICREST)* (pp. 57-60). IEEE.

Hossain, S. M., & Chakraborty, S. (2021). Arduino Based Smart Shoe System for Women Safety, Defense and Integrated Intelligent Tracking, *www.ijaceeonline.com*. 6(1), pp. 1–7.

Humaira, I., Ahmed, K. A., Roy, S., Safa, Z. T., Raian, F. M. T. H., & Ashrafuzzaman, M. (2021). Design and development of an advanced affordable wearable safety device for women: freedom against fearsome. *Adv. Sci., Technol. Eng. Syst. J.*, *6*(2), 829-836.

Hyndavi, V., Nikhita, N. S., & Rakesh, S. (2020, June). Smart wearable device for women safety using IoT. In *2020 5th International Conference on Communication and Electronics Systems (ICCES)* (pp. 459-463). IEEE.

Islam, M. N., Promi, N. T., Shaila, J. M., Toma, M. A., Pushpo, M. A., Alam, F. B., ... & Rabbi, M. F. (2018, November). Safeband: A wearable device for the safety of women in bangladesh. In *Proceedings of the 16th International Conference on Advances in Mobile Computing and Multimedia* (pp. 76-83).

Jatti, A., Kannan, M., Alisha, R. M., Vijayalakshmi, P., & Sinha, S. (2016, May). Design and development of an IOT based wearable device for the safety and security of women and girl children. In *2016 IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT)* (pp. 1108-1112). IEEE.

Kaur, D., Chahar, R., & Ashta, J. (2020, March). IOT Based Women Security: A Contemplation. In *2020 International Conference on Emerging Smart Computing and Informatics (ESCI)* (pp. 257-262). IEEE.

Khandoker, R. R., Khondaker, S., Nur, F. N., & Sultana, S. (2019, December). LIFECRAFT: an android based application system for women safety. In *2019 International Conference on Sustainable Technologies for Industry 4.0 (STI)* (pp. 1-6). IEEE.

Sen, T., Dutta, A., Singh, S., & Kumar, V. N. (2019, June). ProTecht–Implementation of an IoT based 3–Way Women Safety Device. In *2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA)* (pp. 1377-1384). IEEE.

Sogi, N. R., Chatterjee, P., Nethra, U., & Suma, V. (2018, July). SMARISA: a raspberry pi based smart ring for women safety using IoT. In *2018 International Conference on Inventive Research in Computing Applications (ICIRCA)* (pp. 451-454). IEEE.

Venkatesh, K., Parthiban, S., Kumar, P. S., & Kumar, C. V. (2021, February). IoT based Unified approach for Women safety alert using GSM. In *2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV)* (pp. 388-392). IEEE.

Yaswanth, B. S., Darshan, R. S., Pavan, H., Srinivasa, D. B., & Murthy, B. V. (2020, December). Smart safety and security solution for women using kNN algorithm and IoT. In *2020 Third International Conference on Multimedia Processing, Communication & Information Technology (MPCIT)* (pp. 87-92). IEEE.