

IoT based Smart Foot Device for Women Safety

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Abstract - In this paper, an attempt has been made to develop a smart device that can assist women when they feel unsafe. This smart device will be clipped to the footwear of the user and can be triggered discreetly. On tapping one foot behind the other four times, an alert is sent via Bluetooth Low Energy communication to an application on the victim's phone, programmed to generate a message seeking help with the location of the device attached. The results obtained were analysed using Naïve Bayes classifier. In such situations, the aid of a safety device that will inform the victim's family members or the authorities (in severe situations) may help women feel safer, confident and reduce the chances of harassment.

KeyWords— Internet of Things, Bluetooth Low Energy, acceleration sensor, Wearable device, Woman safety

1. INTRODUCTION

In today's world, women come across many situations that make them feel unsafe. Women from various walks of life face situations that make them feel threatened in different environments. In such situations, the aid of a safety device that will inform the victim's family members or the authorities (in severe situations) may help women feel safer, confident and reduce the chances of harassment. Though there are a few Smartphone based solutions for the same, it might not be possible for the victim to reach for her phone in some situations without the knowledge of the perpetrator.

Thus, there is a need to introduce a discrete safety device that can be triggered discreetly without any explicit action. The practical applications of the IoT are made possible through enabling technologies such as Bluetooth Low Energy (BLE) which is required to embed intelligence in footwear.

The idea 'Internet of things' has seen a rapid development in the last few years. Emergence of IoT. Devices can significantly improve the quality of living and provide assistance and aid to those in need. Current technological advances in wireless communications and wireless sensors have facilitated the design of smart, low cost, small and lightweight sensor. By coalescing the concept of IoT, wireless sensors and BLE, numerous simple yet effective

smart devices can be developed. The sequence of actions performed by the devices connected are as follows: The devices use wireless sensors to detect any change in the environment. If a valid change is observed, the appropriate message is sent to the other device in the network. Based on the information received, the device can be programmed to behave in a certain manner.

2. LITRETURE REVIEW

India which sees itself a promising super economic hub, is still trapped in the clutches of various evils like molestations, dowry, crime against women, worst among all is Rape. The atrocities against the women can be now brought to an end with the help of a device called suraksha.

This device explains the basic idea underlying suraksha which is to flash a warning giving an instant location of the distressed victim to the police so that the incident could be prevented and the culprit apprehended. This would help reduce crime against women. This paper also summarises other significant works in this field and hence forth discussed suraksha device in a greater detail.

One touch alarm system for women safety using gsm, this device describes about an one touch alarm system for women's safety using GSM. In the light of recent outrage in Delhi which shook the nation and woke us to the safety issues for women, people are finding up in different ways to defend. Here we introduce a device which ensures the protection of women. This helps to identify protect and call on resources to help the one out of dangerous situations. Anytime you senses danger, all you had to do, is hold on the button of the device.

The device consists of a PIC microcontroller, GSM module, GPS modules. The system resembles a normal watch which when activated, tracks the place of the women using GPS (Global Positioning System) and sends emergency messages using GSM (Global System for Mobile communication), to contacts and the police control room. The main advantage of this system is that the user does not require a Smartphone unlike other applications that have been developed earlier. The use of sophisticated components ensures accuracy and makes it reliable.

B'Safe & B'Secure - The Door to Safety Swings-The history of violence against women remains vague in scientific literature. This is in part due to the fact that many kinds of violence against women (specifically rape, sexual assault, and domestic violence) often go unreported or under-reported, often due to societal norms, taboos, stigma, and the sensitive nature of the subject. It is widely recognized that even today, a lack of reliable and continuous data is an obstacle in having a clear picture of violence against women. According to World's Women Organization the crimes against women have increased beyond the thinking of common people. So we propose this device for developing an Android application called B'Safe & B'Secure that ensures both safety and security for women. This app contains unique features such as if the user is in trouble and doesn't have internet connection at that time the text message will be sent to the registered contacts with the user's current location using SOS technique. This app can also be used in case of emergency, the user can trace the location and contacts of nearby hospitals and police stations using GPRS.

Women's in India facing many problems while travelling in a bus or any other vehicles. . Flush in the 21st period anywhere the knowledge is quickly mounting and new-fangled implements were established but still women and girls are facing problems. Women's cannot move out from home at night times and even in day time crowded areas also have many incidents are happen. For these issues "Swarma" a women safety device aims to design and develop a Smart GPS Watch with Smart Android App which will track the position of the attached person and also to monitor all sudden fall and Irregular Attacks. And also aims to create any number of predefined security zones within a campus area and other places.

Safety of women in present scenario is very important. Safety is the most important requirement because the cases of harassment and rapes are increasing Therefore, a compatible safety device is designed. This compatible safety device is named as smart glove which is easy to carry and easy to use. This smart glove will give the shock to the attacker without killing him. Smart gloves are a good option for providing safety in this case. It is a portable device which is easy to carry and use. It is an electrical self - defence device that uses high voltage to stop an attacker.

Touch me not - a women safety device -Women security is a major issue of concern in today's world. Women are subjected to unethical physical harassment. Women safety methods such as various mobile apps have been tried and implemented, but the need of the time is that they need is a device that can be carried everywhere easily. Here we present Touch Me Not, an idea to design one such device which can be attached to the clothing. It will be a button which will be attachable to the clothing. This button will be connected to the system which has two modules, one which can be used when someone makes some sort of unethical

movement and the other one which can be used when you sense danger. The first module can be used just to record that is making a short video to capture the assailant, while the second one can be used during times of danger to send your location to family or friends as well as it alerts the nearest police station, such that help can reach as soon as possible. The tools that we will be using include microcontrollers, GSM and GPS modules for the hardware section, and python for the software section.

Implementation and evaluation of bluetooth low energy for wireless sensor network as the growth and enthusiasm for IoT increases, energy consumption and efficiency is of immense importance in order to develop maintainable and dependable sensor networks. In this device, we implement and evaluate a wireless sensor network using Bluetooth Low Energy (BLE) as the communication standard with regards to energy consumption and range to be a highly viable capabilities. We found BLE option for such systems, yielding long battery life for systems where long-range capabilities are not needed. . BLE allows for much lower energy consumption.

3DESIGN OF SMART-FOOT DEVICE

3.1 DESIGN

The system design includes an Arduino microcontroller with a tri-axial accelerometer and a Bluetooth Low Energy module embedded in it. This device is clipped to the foot wear to be used. The first step is the clipping of the device to the footwear of the user. The next step is the establishment of Bluetooth connection between the device and the user's Smartphone. The device must be paired with the user's Smartphone to work in conjunction with the application. Hence, no unauthorized user can connect to the device. Since BLE (Bluetooth Low Energy) is being used, the phone can be connected to the device without much loss in the battery life. The acceleration sensor present on the device will record the acceleration reading in x, y and z axes once every second. When the user taps her left foot from the back using the right foot, the accelerometer senses a change in the reading in the z axis and an alert is sent to trigger the user's phone via BLE connection.

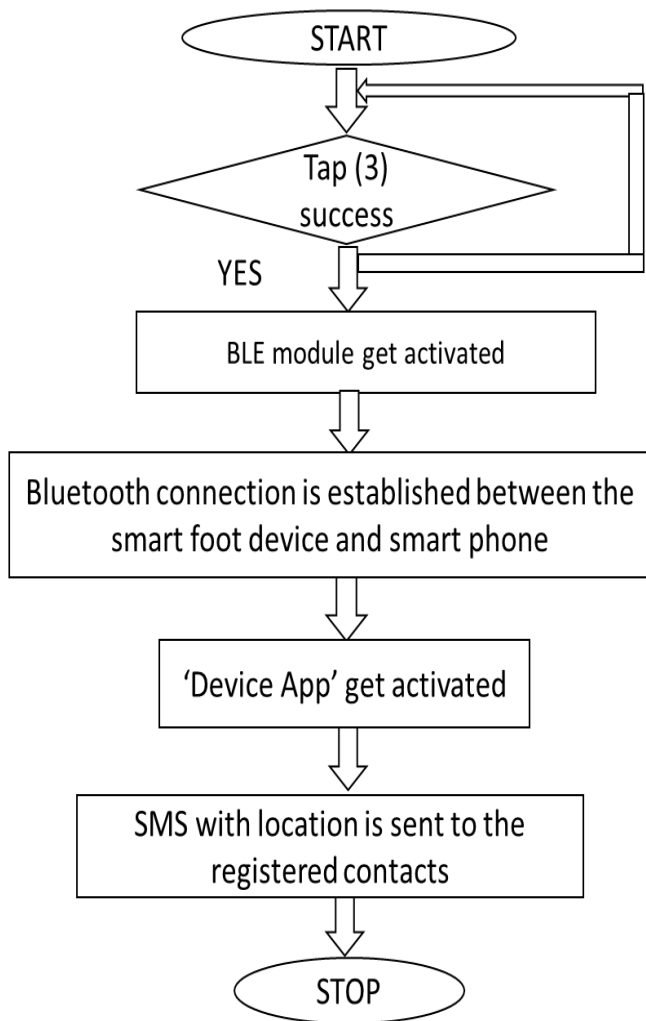


Fig-1 Block diagram of proposed system

On receiving the alert from the device, an application on the smartphone is programmed to send its location to four contacts that the user can preset on the application. The application can further be programmed to inform authorities

3.2 COMPONENTS SPECIFICATION

- Arduino UNO
- ATmega 328 microcontroller
- LBM313 BLE Module
- BMA250 Accelerometer sensor
- GSM Module
- GPS module

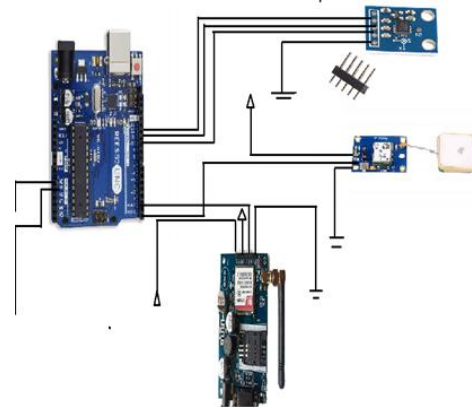


Fig-2 Circuit Diagram

4 RESULTS AND CONCLUSION

The walking and tapping scenarios are represented graphically in Figure 4. The x-axis indicates the time in seconds and the y axis represents the acceleration sensor reading in the z axis in raw format. One unit in the raw format corresponds to $3.91 \times 10^{-3} \text{ g}$. The walking phase is marked as the red line region and tapping phase is represented as the green line region. The average z axis acceleration values for walking and tapping across all subjects is represented as a scatter plot in Figure. A clear demarcation of the readings in each region is observed

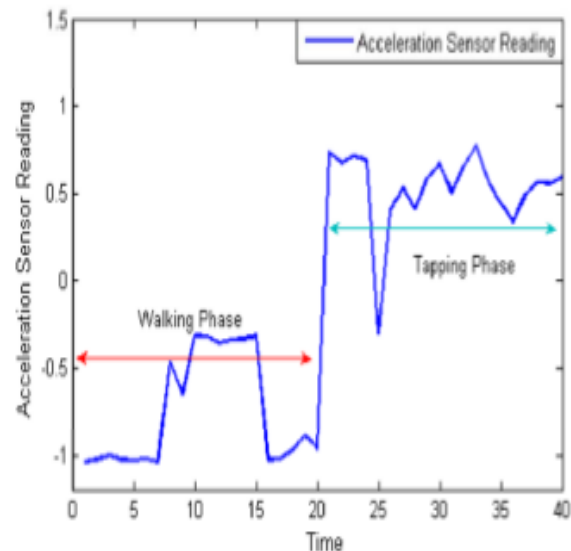


Fig-3 Analysis of the accelerometer data for walking and tapping phase

The acceleration sensor readings in the walking phase is observed to be in the negative region and that in the tapping phase is observed to be in the positive region. The average value of the acceleration sensor reading with respect to the z axis for the walking phase was found to be -0.7583 and in the tapping phase, it was found to be 0.5309.

The statistical values with minimum and maximum acceleration values for the two phases, namely, walking and tapping are represented in Table 1. The results of the classifier performance measures are represented in Table 2. The device showed a success rate of 97.5%. The best performance was achieved in the tapping scenario with 100% accuracy, sensitivity and specificity. The accuracy of the walking scenario is observed to be 95%.

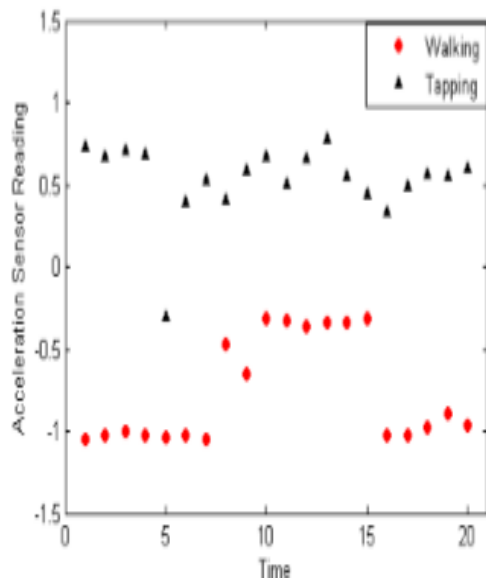


Fig-4 Scatterplot for walking (red circles) and tapping (Black triangles) phases

This work was aimed at developing a smart low-cost device to help women feel safer and prevent the occurrence of rape, harassment and other dangerous situations. The design is developed using an Arduino microcontroller with a tri-axial accelerometer and a Bluetooth Low Energy module embedded in it. This device is clipped to the footwear of the user. The automated system gave a high accuracy of 100% in the tapping scenario and 95% in the walking scenario. This low cost system does not require the user to have physical access to her smartphone and the device is well hidden. To trigger the device, the user is not required to press any buttons or carry any object in her hand.

The user has to simply tap her left foot from the back using her right foot and a trigger will be sent to her smartphone which will send an alert via SMS to five preset numbers containing the location details of the device. The size and form of the device make it easy to incorporate in daily life. Due to its small size, it is discrete and difficult to notice. In the future, an appropriate case can be designed for the device to improve its durability and prevent any hardware damage. This study has a few limitations such as the trigger of a false alarm if the user taps her foot from the back

involuntarily. The device works well only in scenarios where the user's feet are at ground level. By working on more number of scenarios and with sufficient collection of data (subjects with different age group, gender, and height), the reliability and robustness of the system can be improved

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REFERENCES

- [1]Ahmad Ashari, Iman Paryudi, A Min Tjoa, "Performance Comparison between Naïve Bayes, Decision Tree and kNearest Neighbour in Searching in an Energy Simulation Tool" International Journal of Advanced Computer Science and Applications, vol. 4, no. 11, 2013.
- [2]Akshata V.S. , Rumana Pathan , Poornima Patil and Farjana Nadaf,"B'Safe & B'Secure", International Journal Of Core Engineering & Management (IJCEM), vol. 1, no. 7, October 2014 .
- [3]Daniele Miorandi, Sabrina Sicari, Francesco De Pellegrini, Imrich Chlamtac, "Internet of things: Vision, applications and research challenges", Ad Hoc Networks, Int J, vol. 10, no. 7, pp. 1497–1516, April 2012.
- [4]Jagori and UN Women 2011 "Report of the Baseline Survey Delhi 2010" Safe Cities Free of Violence Against Women and Girls Initiative , 2010.
- [5]Jia Liu, Canfeng Chen, Yan Ma, Ying Xu, "Energy analysis of device discovery for bluetooth low energy", IEEE Vehicular Technology Conference, September 2013, pp. 1–5.
- [6]K. Hajian-Tilaki, "Receiver Operating Characteristic (ROC) Curve Analysis for Medical Diagnostic Test Evaluation.," Casp. J. Intern. Med., vol. 4, no. 2, pp. 627–35, Jan. 2013.
- [7]M. Siekkinen, M. Hienkari, J. K. Nurminen, and J. Nieminen, "How low energy is bluetooth low energy?"

Comparative measurements with ZigBee/802.15.4," in 2012 IEEE Wireless Communications and Networking Conference Workshops, WCNCW 2012, 2012, pp. 232-23

[8]Nishant Bhardwaj, Nitish Aggarwal, "Design and Development of "Suraksha"-A Women Safety Device", International Journal of Information & Computational Technology, vol. 4, no. 8, pp. 787-792, 2014.

[9]Premkumar P, CibiChakkaravarthy R, Keerthana M, Ravivarma R, Sharmila T "One Touch Alarm System for Women's Safety Using GSM" International Journal of Science, Technology and Management, Volume No 7, Special Issue No 1, March 2015.

[10]Ravinder Kumar, "Women Exploitation in Modern Society", International Journal of Advance Research in Education, Technology & Management, vol. 2, no. 2, August 2014.

[11]Remya George, Anjaly Cherian V, Annete Antony, Harsha Sebastian, Mishal Antony, Rosemary Babu T, "An Intelligent Security System for Violence Against Women in Public Places" International Technology, vol. 3, no. 4, Journal of Engineering and Advanced April 2014

[12]X. Wu, V. Kumar, J. Ross Quinlan, J. Ghosh, Q. Yang, H. Motoda, G. J. McLachlan, A. Ng, B. Liu, P. [13]S. Yu, Z.-H. Zhou, M. Steinbach, D. J. Hand, and D. Steinberg, "Top 10 algorithms in data mining", Knowledge and Information systems, International Journal, vol. 14, no. 1. 2008