Smart and Convenient Device To Fight Against Women Assault

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ABSTRACT

This paper discusses the concept of a smart wearable strip for women safety. The major advantage of this strip over other proposed devices is that it can be worn anywhere according to convenience of an individual, also it has wider range as LAN module is used. The purpose of this strip is to create a safer environment for women. At present there are few such devices in market using Bluetooth services. But Bluetooth appear to be an unreliable medium for signal transfer with its range being within a room. Therefore, the idea of this paper is to have LAN based signal transfer. This strip has motion sensor for forceful removal of device, voice sensor for automatic trigger of the strip.

KEYWORDS- *IOT, LAN, Bluetooth, Arduino, MAN module, Naïve Bayes classifier*

I.INTRODUCTION

Internet of Things (loT) [1] refers to the set of devices and systems that stay interconnected with real-world sensors and actuators to the Internet. loT includes many different systems like smart cars, wearable devices [2] and even human implanted devices, home automation systems [3] and lighting controls; smartphones which are increasingly being used to measure the world around them. Similarly, wireless sensor networks [4] measures weather, flood defences, tides and more. There are two key aspects to the loT: the devices themselves and the server-side architecture that supports them [5]. The motivation for this wearable comes from the increasing need of women safety in current times. This paper focusses on the key aspect that any women in case of emergency can be helped by the people around her until the police reaches. Most of the wearable devices available these days works on Bluetooth [6]. But Bluetooth seem a very unreliable source of signal transfer. Therefore, it is intended to use LAN as the mode of signal transfer, as it has wider range. The platform on which this project will be running on is the Arduino [7] Uno microcontroller board based on the ATmega328P.This strip can be worn by women under her clothes such that it is hard to reach. In case of forceful removal of the strip a consent message is sent to the victim's mobile with a time period of 20s to make a choice between yes or no. If the time limit exceeds a message is sent to the registered contacts, nearby people and nearby police station with location details using inbuilt GPS. It can also be triggered by loud scream of the victim which will be detected by the voice sensor in the strip.

II.LITERATURE REVIEW

Many developments have been done for women's safety including wearable armband, Intelligent Security System and smartphone application. Design and implementation of safety armband for women and children using ARM7 [8] was published on 24 September, 2015 by Glenson Toney, Fathima Jabeen and Puneeth S. The device is automatic cum manual device, it has three options to turn it ON. Switch is ON by a gesture of hand. This proposed system sends panic alert message and collect images for evidence. On initiation, the live video is streaming to control room along with the location to predefined mobile station. The armband has the switch option to turn the device ON and reset. It can be used for medical emergency as it includes fall detection senor and flex sensor. The armband is less prominent as it is visible. The use of flex sensor has limited biocompatibility for prolonged contact.

A Smart foot device [9] for women safety was published on 25 july, 2016 by Nandita Viswanath, Naga Vaishnavi Pakyala and G. Muneeswari. The devices use wireless sensors to detect any change.The user not require to have physical access to her smartphone and the device is well hidden. The uses Bluetooth range is limited and user must install a Smartphone app.The trigger of a false alarm if the user taps her foot from the back involuntarily.

A Smart security solution [10] for women based on Internet of Things (IOT) was published on 24 November 2016 by G C Harikiran, Karthik Menasinkai and Suhas Shirol. This device is combination of multiple devices, hardware comprises of a wearable "Smart band". The application is programmed which includes Human behavior and reactions. The initial action has to be triggered by the victim. The device is prominent and visible to others.

A Prototype based on RFID and GPS technologies [11] for women safety was published on 19 December 2016 by Shaik Mazhar Hussain, Shaikh Azeemuddin Nizamuddin, Rolito Asuncion, Chandrashekar Ramaiah and Ajay Vikram Singh.The device uses RFID technology to get the information and communication can be done through GSM and the location can be tracked. The distance range is high for this type and it is a battery-operated type. But it is expensive and faces signal interferences. The information access to invalid and unauthenticated users.

III.EXISTING SYSTEM

Developed by researchers at Massachusetts Institute of technology, Intrepid is a smart sticker which was manufactured by keeping in mind the concept of women's safety. This smart sticker was build for protecting women from unwanted attention and assaults. Primarily it can be attached to any piece of clothing but it is created as such that it can be placed anywhere which is hidden from the view of any other person. Thus, is can be glued to any intimate clothing piece of women to pass detection. When the piece of clothing is being removed forcefully, the sticker will detect it immediately and send out a distress signal. The device is connected to a phone via Bluetooth signal. When the distress signal is detected by the app on the phone, it sends text messages to the listed contacts and also sounds a loud alarm so that people nearby can get alerted. The device is made up of conductive, non-conductive and hydrogel layer. The conductive and non-conductive layers are composed of various sensors and other electric circuits whereas the hydrogel layer is the outermost layer which is used to stick the device on cloth. Intrepid works in both active and passive mode. That is, active mode is when the victim is conscious to confirm the nature of emergency. And in passive mode the app automatically sends the required message after a certain amount of time if the victim is unconscious and cannot fight the attacker. The device was surveyed on women who were assaulted sexually, some volunteers etc. to understand the environment in which it will be working. Assessment of clothing appeal, functionality of the electrical components, cultural sensitivity etc. was done and feedback was provided for much better understanding and general sense of security while wearing the device. The device was created by keeping in mind the initial stages of sexual assault i.e. disrobing and is not available in market yet.

IV.PROPOSED SYSTEM

The device initially developed by the researchers of MIT had some drawbacks. Thus the proposed system will overcome those shortcomings and also add some new functionality. First of all, the range of connectivity which is Bluetooth in the existing system is increased to a larger range such as Wi-Fi. Connectivity range is increased so that the device can connect with the app on phone even if it is not available in the same room. Consider a scenario, suppose the phone fell off from a person at a certain distance and at the time of assault is not in the range of Bluetooth. That's why the increase in the range of connectivity is a much needed necessity. Apart from this, various other sensors are added in the new enhanced device, such as voice sensor which after some programming will react to a certain decibel of sound. Motion sensor will record regular interaction pattern of the user with other person and will react to any forceful contact or gesture. These sensors will also record the normal disrobing pattern of women and thus in passive mode will react to any change in the disrobing pattern. Apart from these changes in the device, many changes will be done in the app to which the device sends the signal. The app along with sounding a shrill alarm will also switch on the flashlight to guide help to the victim. Both these functions won't stop until a proper authorisation code is provided by the user. Also the app will send notification to nearby phones in form of text message or pop-up along with registered contacts and nearby police stations so that help can come immediately. The app will be using Wi-Fi range to connect with the device and other nearby phones. With these enhancements, the device will be much more feasible to use.

V.SYSTEM ARCHITECTURE

In order to implement the proposed idea a green bean is used. A green bean is an arduino microcontroller with an embedded tri-axial acceleration sensors. The user's smart phone and the device will be connected by a Bluetooth Low Energy (BLE) connection. Bluetooth Low energy connection is achieved using the LBM313 Bluetooth Module. The LBM313
BLE module can support data rates between 250 kbps and 1 Mbps and operates at a voltage range of 2-3.6 V. The Bluetooth Low Energy connection is used as it consumes a very small fraction of the power consumed by Classic Bluetooth radio. It imparts intelligence to the controller such that the host is asleep till an action has to be performed. In addition, Bluetooth Low Energy provides an

enhanced range of over 100 meters.

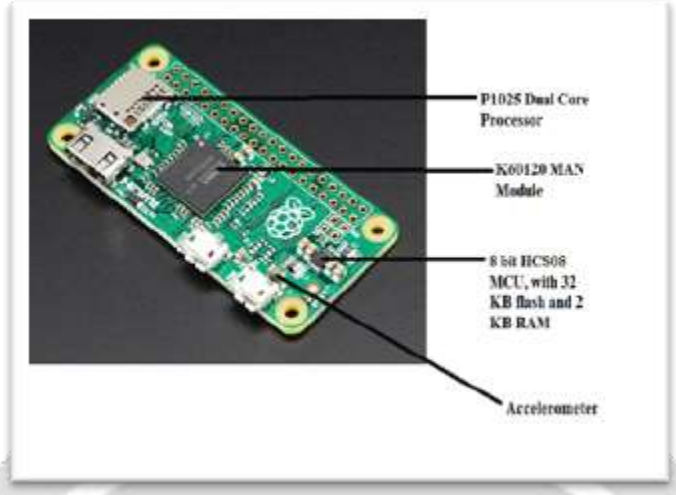

FIGURE 1: DEVICE HARDWARE

The device will contain a MAN network module so that it can extend the range of communication to the nearbuy police stations as well in case the registered contacts could not approach the victim. The MAN network connectivity will be obtained with the help of K60_120 MAN module.

The K60_120 module consist of 10 low-power modes with power and clock gating for optimal peripheral activity and recovery times. Run power consumption down to 350 µA/MHz and static power consumption down to 5.6 µA, full state retention and 6 µS wake-up. Lowest static mode down to 280 nA. It has a full memory and analog operation down to 1.71 volts for extended battery life. It also consist of low-leakage wake-up unit with up to eight internal modules and 16 pins as wake-up sources in low-leakage stop (LLS)/very low-leakage stop (VLLS) modes and low-power timer for continuous system operation in reduced power state.The module also has a mixed signal capability i.e. four high-speed 16-bit analog-to-digital converter (ADC) with configurable resolution. Single or differential output mode operation for improved noise rejection. 863 ns conversion time achievable with programmable delay block triggering. Two 12-bit digital-to-analog converter (DAC) for analog waveform generation for audio applications. Up to four high-speed comparators providing fast and accurate motor over-current protection by driving PWMs to a safe state. 4 programmable gain amplifiers with x64 gain for small amplitude signal conversion. Analog voltage reference provides an accurate reference to analog blocks, ADC and DAC, and replaces external voltage references to reduce system cost. Flex Timers with a total of 20 channels. Carrier modulator timer for infrared waveform generation in remote control applications is used. The channel periodic interrupt timer provides time base for RTOS task scheduler or trigger source for ADC conversion and programmable delay block. The accelerometer used is BMA250 is a digital acceleration sensor. The sensor allows measurement of accelerations in 3 perpendicular axes and is used to sense tilt, taps and motion. Upon tapping the acceleration sensor reading with respect to the z axis undergoes a distinct change. This property is used to detect and trigger an alert when a woman is in danger.

By programming the Arduino appropriately, after the detection of the tap, a trigger can be sent with the aid of the Bluetooth module via the established Bluetooth connection to the user's smartphone. The user's smartphone, upon receipt of the trigger, alerts an application on it. The application is programmed to send a message for help with the location attached via Short Message Service(SMS) to contacts that the user will be prompted to select after downloading the application. At the same time by using the MAN module the alert will be sent to the nearby police stations as well.

In order to analyze the performance of the device, Naïve Bayes classifier, which is a supervised learning method, is used. Forty data points are considered in each case for training as well as
testing purposes where the first twenty data points represent the tilting phase and the next twenty data points represent the tapping phase. The average value for the tilting and tapping scenarios are recorded each time the protocol is performed by each subject. To ensure that there is no bias, cross validation is performed. The Naïve Bayes Classifier is simple to comprehend and can be implemented with ease. It is suitable in cases where the number of observations is not very high.

Also, the Naïve Bayes Classifier shows better Accuracy, F Measure and AUC in comparison to a Decision Tree. As this device will be triggered in dangerous situations, an algorithm achieving a high accuracy is essential. In the confusion matrix, the True Positive (TP) condition is satisfied when the classifier correctly identifies the tapping action,

the True Negative (TN) is satisfied when the classifier identifies a walking scenario correctly, the False Positive (FP) condition exists when the classifier incorrectly identifies tilting as a tapping scenario, and lastly, the False Negative (FN) condition exists when the classifier falsely identifies the tapping scenario as tilting. These four parameters are used for evaluating the performance of the classifier with respect to criterions such as accuracy (ARY), specificity (SPY), sensitivity (SEY) and F-measure (FMR) . Using the receiver operating characteristics, the AUC can be computed as follows:

METRIC FORMULA

$$ACCURACY(ARY) = \frac{TP + TN}{TP + FN + FP + TN}$$

$$SPECIFICTY(SPY) = \frac{TP}{FP + TN}$$

$$\text{SENSITIVITY(SEY)} = \frac{TP}{TP + FN}$$

$$F - MEASURE = \frac{2TP}{2TP + FP + FN}$$

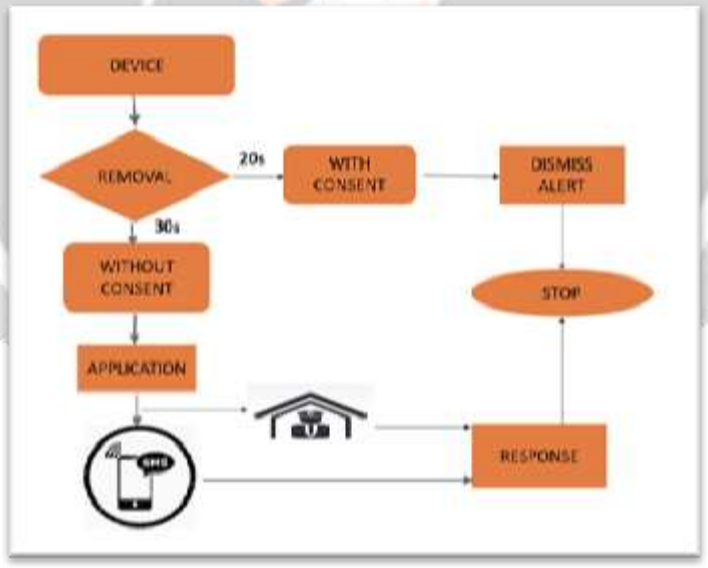

FIGURE 2: WORK FLOW

VI.CONCLUSION

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 can be attached anywhere according to womens convince. The automated system gave a high accuracy in tapping, motion and tilting 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. Removal of device or above mentioned scenario then a trigger will be sent to her smartphone which will send an alert within 20 second if it is

with consent then the alert is dismiss otherwise after 30 second the device is connected to application which will send an alert via SMS to emergency contact and also to the nearby control room 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.

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