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Smart Handheld Intelligent Embedded Locating Device (SHIELD)

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Abstract - — *In today's world, the use of smartphone gadgets such as smartwatches has increased rapidly, and hence, these wearable technology technologies can be used efficiently for personal security as well. The crimes against women have increased inadvertently and we see articles about heinous incidents happening across the country every day. Women all over the world are facing a lot of physical harassment in public places such as railway-bus stands, foot paths etc. These incidents have awakened us to find new solutions for women safety. This paper proposes a solution in the form of a smart watch, SHIELD (Smart Handheld Intelligent Embedded Locating Device) which is an innovative safety device for women, senior citizens and anyone who needs assistance in an urgent situation. SHIELD is a personal protection smartwatch that contains a distinctive hand gesture-controlled pepper spray embedded in the smartwatch, which can help the user in case of assault. A single click or hand gesture identifies the location of a place through GPS and sends a message comprising the location to the pre-registered emergency contacts and police portal. Android App integrated with watch includes features such as sending emergency messages, GPS tracker, in-app police complaint, hospital and ambulance finder, and conventional smartwatch features such as pedometer, sleep monitoring and activity tracker. Pepper Spray is attached inside the watch which can be triggered with a customized hand gesture or manual push-button.*

Keywords—*Women safety, smart wearable device, gesture control, mobile application*

1. INTR0DUCTI0N

The National Crimes Bureau of India had reported that every three minutes a crime against women is committed and in 2011 there were around 228650 cases reported but by 2015 the number had reached 300000 which is a whopping 44% increase. Also statistics have shown that every two out of three women are harassed at least once a year. A survey conducted by Delhi government's Women and Child Development Department, around 80% of the women in the capital have fear regarding their safety. Today women are not able to move freely even in the streets due to security reasons. Day by day women harassment is increasing. Safety is a major issue in India and also in other countries especially for women. In the current scenario it is very much essential to save women from harassment and violence. Though Government has provided safety through rules and regulations, security is a major concern. Women have reached everywhere in every field but still safety is not assured for them. Women in India, a better half of Indian society, are becoming the most helpless section as far as their safety and security is concerned. As of now we alone can't change society totally but we can increase the security of women by using modern technology.

Nowadays though there are many apps and devices that have been developed for women safety via smartphone which can be activated by touch, one click or shaking the mobile. It is not possible to carry mobiles in our hand in all circumstances and also to make a call, click on it or shake it, so here we introduced a new technique using smart hand-wearables.

This device gets activated by the victim on being assaulted just by the motion of the hand or click of a button that will start the pepper spray and fetch her current location. The location will be sent to predefined emergency contact numbers or police through the SHIELD app present on the victim's smartphone thus preventing the use of additional hardware devices/modules, making the device compact and with increased battery life.

It is integrated with an android application having 3 main features:

- Sending messages to emergency contacts
- Immediate ambulance call
- Online Police complaint

On pressing the panic button or sensing the hand motion, the device gets activated and identifies the location

through Global Positioning System and sends the emergency message with location coordinates to registered contacts and police portal. In the Police service, users can complain or file an FIR regarding this issue. An automatic call for an ambulance will be made.

2. LITERATURE SURVEY

Arduino based Smart Watch [1]

In this the main functionality is building a watch using Arduino which consists of a Bluetooth module for transmitting data to the phone and which is also a low power device. It also consists of a vibration motor that sends an alert message to the person wearing the watch like a feedback mechanism. This watch consists of a heart beat sensor which helps in monitoring heart rate. To conclude the smartwatches used commercially these days work on this principle. Design of Smart Watch System Based on E-paper The watch consists of the Bluetooth 4.0 module and the STM32F103 CPU, Acceleration Sensor transmits the data to the CPU through I2C protocol. Here they have used microelectronics and micro-machining to create sensors that are Acceleration Sensor which is small size, light weight, low cost, low power consumption, high reliability, and suitable for mass production. E-paper technology is electrophoretic display technology is used as display panel Smart Wrist Watch. In this the smart watch uses a PIC18F4550 microcontroller and Temperature sensor to measure body temperature and a led display to display the readings. It has a calorie burn calculator which uses Harris-Benedict equations that multiplies with activity level.it also has SpO2 to measure the oxygen saturation level in blood and a clock to display the time.

Control with gestures [2]

Due to the difficulty in interacting with smart watches which are small in size, it is well equipped with sensors such as accelerometer and gyroscope to track the movements of the user. A system is proposed to store and classify the built-in sensor data. The start of action can be detected using an algorithm and can be easily segmented from continuous action data. A bidirectional deep neural network is incorporated to increase the accuracy as high as 96%. An app is also developed to inference gestures in real time. This system is capable of collecting, processing, storing and classifying obtained sensor data from the smartwatch using a bidirectional LSTM based model.

Serendipity: Finger Gesture Recognition using an 0ff-the-Shelf Smartwatch[3]

Serendipity proposes a new technique for finger gesture recognition where in fine-motor finger gestures are recognized using motion sensors. These systems can distinguish between 5 fine-motor gestures such as pinching, tapping, rubbing fingers, waving and squeezing. The paper explores the feasibility to use only accelerometer and gyroscope on wearable devices to detect gestures. This system works with an average f1-score of 87% when the smart watch is worn is 2 different ways. It was observed that the gesture set does not have to be too long for the recognition to be robust.

Abhaya: An android application for the safety of women [4]

This paper talks about the android application based security system which has the feature of sending location of the user to the contacts through SMS and also updates by sending it every five minutes. Application only contains Primary Button for emergency and has no fail-safe method in case of Connection Issues. The Application uses a Location encoder which translates the location of user to string and sends the contacts string location. This system isn't efficient in case of low bandwidth and theft issues and also this feature can't be used in case of emergency or incident, but can be helpful in post emergency period.

SMARISA : A Raspberry Pi based Smart Ring for Women Safety Using IoT [5]

The paper aims at designing a device that is more accessible and portable to help the victim to reach her family and friends in an emergency. It also helps the victim reach medical health services. The device is in the shape of a ring and has a pi camera and buzzer embedded in it. It uses Raspberry pi Nano which enables the camera module to capture images and store it. It is connected to the phone via an application that uses gps tracking to find the victims location and a messaging service to alert emergency contacts about the incident. The camera module records the crime for evidence which is turned into an url and sent to the police along with the location for proof.

Athena: A Mobile Based Application for Women's Safety with GPS Tracking and Police Notification for Rizal Province [6]

This application is designed to prevent the crimes before it happens. It can also be used to help track the repeating offenders in that area

The system interface provides three buttons. A SMS button that will send a pre-recorded message to the nearest registered police station mobile number and registered family member(s). then a button which automatically dials the nearest registered Police station phone number. Finally, a GPS button which sends distress signals continuously bearing the coordinates of the user for tracking purposes.

Stay Safe Application [7]

This application has a database module to register the emergency contacts, a gps module to send location to these

contacts, a GSM system module to send and receive messages using GPRS. It also has an activate button which activates data services automatically and sends the location to the emergency contacts via sms. It also enables the camera which records the scene happening. This image is also sent to the contacts.

Women safety Device and application- FEMME [8]

This paper proposes to use an all-in-one device that could provide emergency help just by the click of the button which would send a distress signal to pre-registered contacts. It also has a hidden camera, GPS, and Audio-recorder built-in. The device contains a GSM module and an ARM controller for low power consumption. They also made an android application that had features such as Video Recorder, women Security and SOS message.

Smart Foot device for Women Safety [9]

In this paper, they have attempted to make a device that can be clipped to the footwear or sandals of the user and can be triggered without notice. It sends the distress signal to the nearest registered person for help. The device uses the Bluetooth module to connect to the smartphone. The acceleration sensor present in the device checks for the triggers which are simple taps on the ground. The smartphone sends the live location of the user to the registered contacts. They used the Naïve Bayes classifier to distinguish between normal walk and tap by the user.

3. METH0D0L0GY

3.1 SYSTEM ARCHITECTURE

Based on the total design of the system, the hardware and software of the system is a real-time monitoring of the body condition and location details in order to provide immediate help. The user can protect himself by pressing the switch thereby it automatically sprays pepper solution and helps to deter the person harassing her/him. The hardware is developed in embedded C language to demonstrate the system capability in providing real-time response. Using the location information supplied by this system, the location is traceable using GPS through Google Maps.

3.2 S0FTWARE IMPLEMENTATI0N

The processed design will be implemented by using both android application and hardware wrist band module. The flow diagram describes the functionally of the wrist band as to how it works and its connections.

• Hand gesture detected: This is one of the main features of SHIELD. It activates the gadget by a simple hand gesture

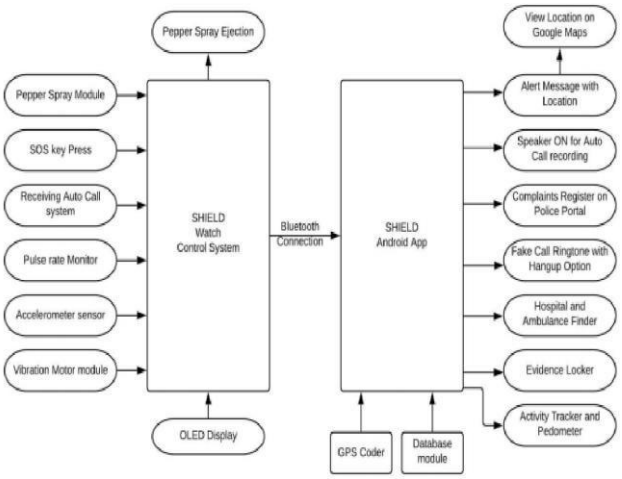

Figure 1 System Architecture

such as a snap. There might be situations where the user performs the hand gesture in normal situations when the activation of the device is not required. By taking such cases into consideration a vibration is caused after sensing the hand gesture. This has to be confirmed by the user. If the pre-defined hand gesture is detected and it is confirmed by the user after sensing the vibrations, then the pepper spray is ejected and the live location is sent to the emergency contacts. The emergency contacts are previously listed and the user's live location is sent immediately to them.

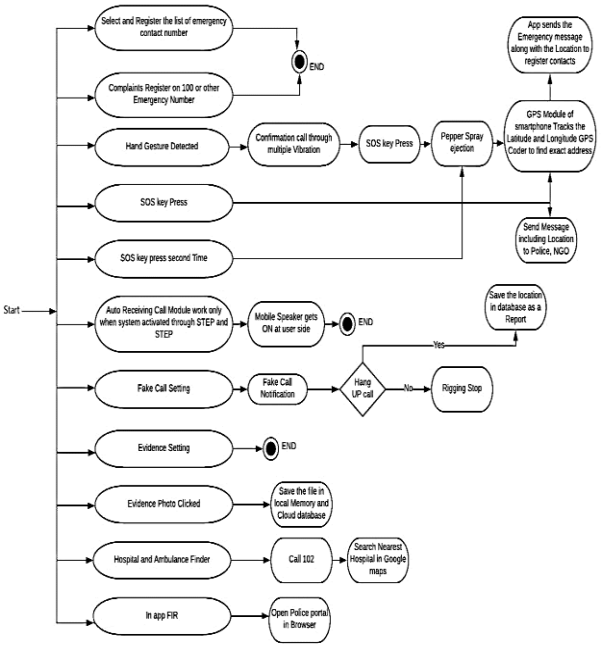

Figure 2 Software flowchart

• SOS key (single press): There will be an SOS key present on the device. It is used to activate the watch during emergency situations. By the single press of the button live location to emergency contacts and nearby police stations is sent. In situations when performing the hand gesture is not possible a simple press of the SOS key will activate the device and perform its functions.

• SOS key (double press): The SOS can be pressed twice to activate another function of the device. By pressing the SOS key twice, the user can manually eject pepper spray. In this case is it not required to perform the hand gesture to eject pepper spray.

• Fake call setting: This feature causes a fake ringing in the user's phone creating an illusion that the user is getting a phone call. The fake ringing generated will make the attacker conscious. The user will also be able to leave the place pretending to talk on the phone.

• Emergency contact: it gives the user an option to store contact details so that they can be called during an emergency.

• 100 or other emergency number: automatic contact is made to the nearby police station or any NGO.

• Hospital and ambulance finder: Finds the nearest hospital and alerts ambulances.

• In app FIR: FIR gets filed through an online portal.

3.3 HARDWARE IMPLEMENTATI0N

This is the basic diagram of how all the different components are connected in the SHIELD smartwatch. Arduino Nano is the main Microcontroller and ATmega328 is the processor used in it. We have used a servo motor to pull the trigger where it changes angle from 40 to 70 degree, with a delay of 0.1sec hence it is connected to Butane Gas, as it is the pepper gas. The Hand Gesture Controlled module uses an accelerometer sensor to recognize the gestures. The accelerometer used here is ADXL335 having 3 axis (X Y Z). The accelerometer reads the X Y Z coordinates when we make gestures by hand and send the X Y Z coordinates to the Arduino nano. And we have used a temperature sensor for measuring the body temperature. Oled display to display the readings. Bluetooth is the main communication mode for us devices hence we have used Bluetooth Module (HC-05). This circuit also consists of the Pepper Spray module which ejects pepper spray when the gesture is detected or the button is pressed. On emission it forms a cloud due to which the vision of the attacker is compromised. The pepper spray is highly concentrated and stored in a 5ml diffuser. Once it's depleted it can replenished.

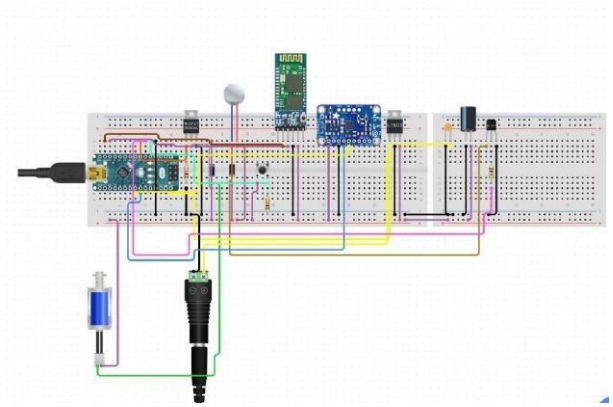

Figure 3 Overall circuit

4. C0NCLUSI0N

SHIELD (A Woman Security Device) has been designed keeping in mind the increasing violence against women. This system is designed to help women in distress situations to call for help as well as alert the surrounding people. This work attempts to keep women safe, it's a portable device so it can be easily carried to any places. It has been developed as an idea to make the security device more portable and comfortable. This system was designed after reference to already implemented system. Here measures are being made to overcome the flaws in previous designs and also to reduce the power consumption.

The location can be sent to family members and police stations by using the application. Also, system send messages to nearby peoples who are all having this app. Overall system works for the safety of the women. Further an alert message will be sent to police station/Helpline. Users don't have to press any button to give an alert message, this is an automatic process. This device is inexpensive, so that common women can use it while travelling outside.

So to conclude, SHIELD system which is very useful application mainly for woman's safety. When one feels that they are in an emergency situation, for example travelling alone at night time they can use this application. So that on one click or hand gesture the location can be sent to pre-stored contacts and to any police station. So once the activate button is clicked it continuously send updated location messages to all authorized persons. So this system is having both safety and security which needs the engineering code of conduct which is essential in the today's world.

5. FUTURE W0RK

In the future along with the gesture detection module we hope to incorporate a voice detection function too. This feature will activate the watch when the user calls out a

trigger word, hence making it more robust and efficient. Since we have only an android version of the app we hope to develop it for iOS and windows operating systems too. More features can be added to the application so it stays up to date and is handy at all times. Make the watch more compact. Move the data from a single database for each phone to a cloud database so the application uses lesser memory.

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