

Safety Solution for Women Using Smart Band and CWS App

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Abstract—Women endure a lot of sexual harassment these days which is becoming alarming day by day. The situation is extremely serious in developing countries as well as underdeveloped ones. Consequently, it poses a significant challenge to women's empowerment as well as to a country's budgetary growth. In this project, we are advancing an IoT device along with an android app that can make women's movement safer. Women can get swift and supreme safety support by pressing the device's emergency switch. If any incident occurs, this device can track the user's location in real-time and send it to the nearby police box and volunteer. The user can also get location of the nearest safe zone by this device as well. In addition, this device functions in both online and offline mode. If there is no internet available, the user can still use the device to access the nearest police box and volunteer support. The device consists of Arduino nano, GPS, GSM, Bluetooth, etc. The aggregate of all these elements collectively offers this device to be affordable and easy to navigate.

Keywords—Women safety, Women empowerment, IoT device, Android app, GPS, GSM, Bluetooth.

I. INTRODUCTION

In the twenty-first century, women have been involved in many activities alongside men. Women are contributing much to the success of society and the country, which deserves praise. However, sadly, the free movement of women are being hampered by sexual abuse. In the present world, sexual harassment is one of the major obstacles to women's empowerment. According to Ananda Bazar magazine, in the last three years (2017- 2019), there were more than 150 rapes in trains and station premises alone in India. Apart from these, there were 802 unpleasant incidents with women at the station premises and 870 inside the train [1]. Working women and female students particularly faced this unfortunate incident. Meanwhile, Bangladesh witnessed a dark night on 6 February 2020. A female student of Dhaka University was raped on one of the busiest roads in Dhaka. The women went to her friend's place by a bus. Mistakenly, she got down at Kurmitola at 7 pm where she was brutally raped and tortured by a deranged person. She became unconscious and found herself in an isolated place at 10 pm [2]. A female SSC examinee was abducted and raped on January 26 of the same year. This incident took place at Tarakanda Upazila in Mymensingh [3]. Also on February 13, 2020 a nurse was gang-raped on her way back from work [4]. There have been many more other rape cases in Bangladesh in

the last few years. For example, on August 25, 2017, a women named Rupa was raped and killed by a bus driver and his assistant in Mymensingh [5]. According to Prothom Alo, on January 21, a bus driver and his assistant of Gbatli Nabinagar reported the abduction of a woman [6]. In April of the same year, a woman was raped in front of her husband inhumanly on a moving bus [6]. All these events serve as immense obstacles for working women and female students. Considering the situations mentioned above, we have designed a system through which a woman will be able to receive administrative and volunteer assistance in a very short time. We have given the highest priority to women's security so we have designed a system with a combination of hardware and software. Because only hardware or only software cannot guarantee complete security. We used a band as hardware and a mobile application as software. Hardware and software are connected to each other via Bluetooth. If a woman is in danger then she will press the emergency switch available in the band. As a result, an emergency SMS will be sent to the user's family as well as at the police box, the traffic police, and certain volunteers who are near the victim. The emergency switch also triggers the "Complete Women Security (CWS)" app which will automatically send the real-time location of the victim to the nearest volunteer. The victim can also see the nearest "safe houses" of that area by using this app.

II. BACKGROUND STUDY

In the past, many researchers have done a lot of work for women safety using different technologies. In the paper [7], the authors designed a device for women safety using raspberry pi and a raspberry camera module. The focus here is on helping the victim by sending the victim's real-time location and attacker's information to the police or to specific individuals. This device is manually controlled. If the victim is in trouble, the smartphone app can perform the above-stated tasks by the emergency switch of the device in her hand. Although this device is working with the safety of women, due to the access numbers being stationary, it will be difficult to get the assistance, if the victim is away from the access number. The authors of [8] designed this project emphasizing on two things. One is self-defense, and the other is to send the location of the victim to the precise access numbers. Raspberry Pi, Arduino Uno, GPS, GSM, etc. are used in this project. Raspberry Pi has been used for real-time photo and video streaming. In addition, GPS, GSM, and Electric teaser are

attached to Arduino Uno, providing real-time location and self-defense of Victim. This device also sends information about the Victim's location to the fixation number, just like the previous device. Moreover, even though the self-defense provided here is beneficial, it is likely that the life of the victim will still be threatened if the number of attackers is more than one. "Reach360" is an android application designed by the authors of paper [9] for women safety. A victim can send her location and wary note to the police station, family member, compatriots, and admin by this app. Then the admin will forward the victim's notification to the users within the 100 meters of the victim. One App user can track another user by the unique code generated by the App. This system can help to secure woman's movement but its benefit is limited considering two things. Firstly, this system would be more beneficial, if it was fully automated and it did not depend on the admin for finding users within the 100 meters of the victim. Also, if the victim is away from the police station, family members and the app users, then her safety would be compromised. This problem can be avoided by developing a system which manages some fixed volunteers for every area. Authors of paper [10] developed a device that secures women's safety in three-way. They also built a mobile application that works using the voice command. This system sends an alert message to a pre-choice number, rings the buzzer, records video and helps to communicate with an emergency number. Authors of paper [11] built a security gadget consisting of GPS, GSM, Raspberry Pi and various types of sensors. Victim's guardian and police can get location information and physical condition of the victim by the smart band. In our work, we designed the system in a way where the above-mentioned problems will be solved.

III. WORKING PRINCIPAL

A. Flow diagram of band

When the user will turn on the device, all modules will be launched simultaneously. The band will check whether the emergency switch has been pressed twice within five seconds or not. If the switch is not pressed or pressed for a single time, the band will not take any further action. But if the band user is in danger and presses the emergency switch on her band twice within five seconds, an emergency SMS will be sent immediately to the nearest police box, volunteers and her family. The location update will be done by the GSM module. We divided each road into several branches where one kilometer was taken for one branch. It is created with the values of latitude and longitude. Police boxes and some volunteers' mobile number of each branch will be provided to the system in advance. When the emergency switch will be pressed, the emergency message will be sent to the police and volunteers of that zone in which the user will be in.

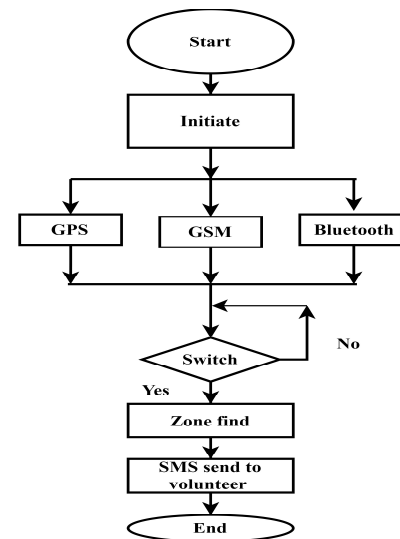


Fig. 1. Flow diagram of smart band.

If a user presses the button from a vehicle, the emergency SMS will be continuously sent with her updated location after every thirty seconds to the police until she presses the emergency button four times. As vehicle can go from one area to another in a very short time, if the vehicle enters the next zone then the system will send SMS to the previous zone volunteers and also to the new zone volunteers.

B. 3D simulation of zone

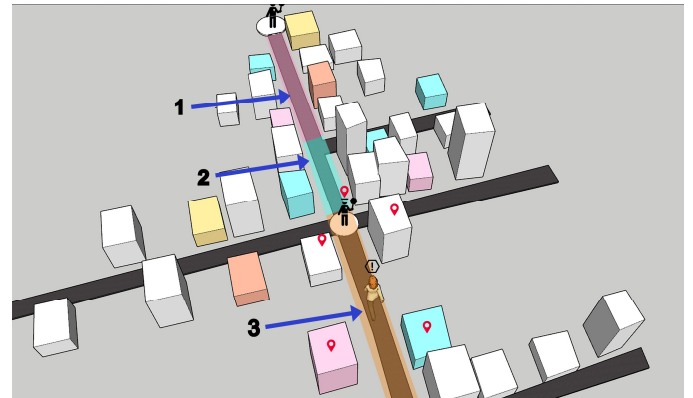


Fig. 2. Zone search.

In Fig. 2, a 3D simulation of how a smart band searches zone and sends emergency messages is shown. Here different colors indicate separate zones. Since the woman is now in zone number 3 in the figure, GSM will send SMS to the previously fixed volunteers and police in that zone. Here the latitude and longitude value of GPS are used to create the zone. We have created a virtual branch with 6 position latitude and longitude values of the outer corner in each region.

C. Flow diagram of App

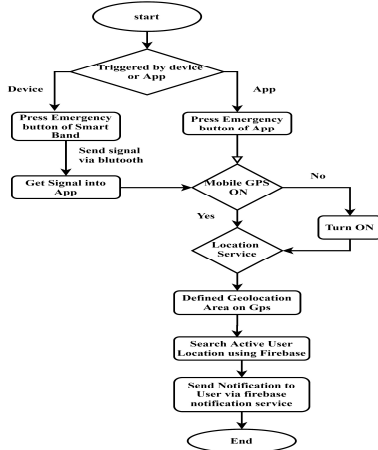


Fig. 3. Working diagram of the app.

The user can trigger the app in two ways. One is through the emergency switch in the app. Another one is the emergency button with Smart band, which transmits signals with the app using Bluetooth support. When the emergency switch is pressed, the system will see if the GPS is ON. If not, the app will turn on GPS location service. The system will be informed about the current location of victim through Google Geolocation Service. The app will then send a notification via the Firebase Notification Service to the closest active user of the victim. As a result, the volunteers will reach out to help her and the attacker will not have enough time to harm the victim.

IV. SYSTEM OVERVIEW

A. Smart band

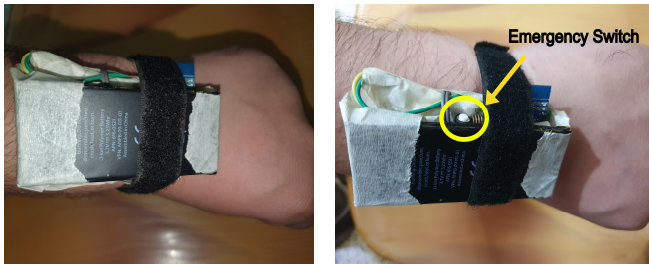
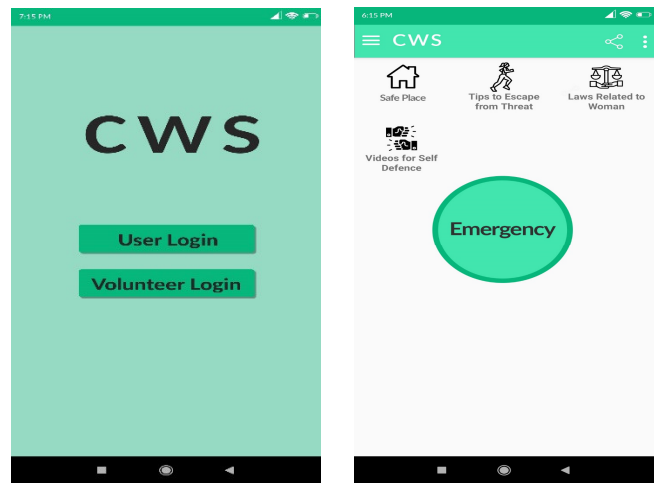


Fig. 4. Prototype device.

The smart band shown in the figure above will be worn by the women like a watch. Here, the white color push button acts as the emergency switch. The HC-06 Bluetooth module connects between this band and the app.

B. App interface

We designed the app to take into account all situations. We will teach women how to be vigilant, we will give her the confidence, and we will take security measures when she will fall in danger through this “CWS” app.



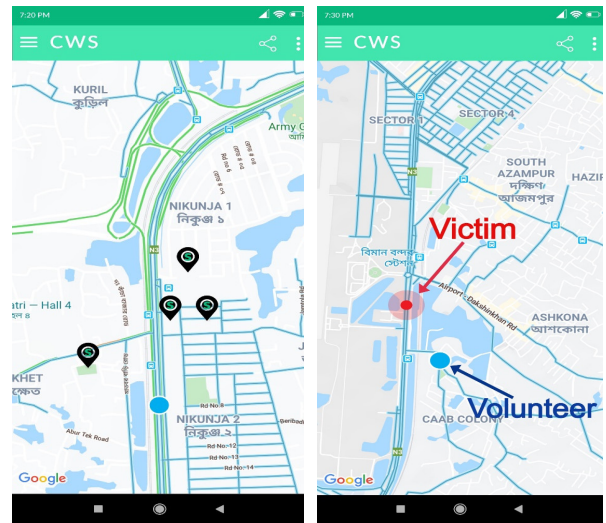
a

b

Fig. 5. App interface.

C. App figure description

Fig. 5.a is the interface of the CWS application's login page. Here, users and volunteers can be registered by providing some information. Figure 5.b is the homepage interface. The homepage has Safe Place, Tips To Escape From Threat, Law Related To Women, and Videos For Sell Defense features, and an emergency button. These three features have been used to raise awareness for women. The "Safe Place" feature will help women to find a secure location. We have already surveyed the full-service area of our system and designated some locations as safe places. If women feel unsafe, they can go there and seek help.



a

b

Fig. 6. App interface (working mode).

Figure 6.a is the “Safe Place” Feature's interface. The green markings that appear in the figure are the “safe places”. Safe Place can be a home, police station, shop or shopping mall that

is already registered in the server. Figure 6.b is the interface of Volunteers. When Volunteers get an alert message, they will see an interface like this when they enter the app. There will be a real-time location of Victim which will be updated after every 5 seconds.

V. NOVELTY OF THE WORK

Maximum Women's safety is the utmost concern of our project. So, we designed our project with few unique features. One of the key features is that our system can work in both online and offline mode. Police and volunteers who are positioned near the user's location in both modes, they will assist the user. On the other hand, the most important and unique feature of our app is that when the user is in trouble, she will get help by fixed volunteers and movable volunteers who are closest to the user. The app user will get help much faster because this app does the job of finding volunteers at its own discretion.

VI. FUTURE WORK

We will add a camera module to the device which will have video and audio recording options. Through the camera, specific information about the attacker can be sent to the police. We will add a watch interface and pulse sensor and Blood Oxygen Sensor with Smart Band so that the user can provide information about her physical condition and her family can feel relaxed by receiving this information. In the app, we will also add a Walking Partner feature that allows users to find a partner with whom she can go to the destination together. This will make her journey safer and secure.

VII. CONCLUSION

Without women's progress, a country cannot move forward, yet we see women suffer a lot for harassment on their way, which is a hindrance to their progress. For this reason, we decided to work on a project which will help millions of women. The main benefit of using this safety system is that women can feel confident when they go outside as they can quickly get support through the system when they are in danger. The device we invented for Women's Safety is made up of two separate tools. One is a smart band and the other is the CWS app. The two tools are able to provide women's safety independently. But it is expected that maximum safety will be ensured when using the full system together. We have encountered some issues in designing the Smart Band. The size of the smart band designed here is slightly bigger, so it can be a little difficult for the user to wear the band. In the future, we will work to make the band more user-friendly by using 3D printing and nanotech. We chose North Dhaka to test the device, so we have surveyed only the police, volunteers and the safe areas of that location. Following, if we want to bring the whole city or country under the system, we must do a lot of surveys which will be very challenging. In addition, a lot of public awareness is needed to motivate people to become volunteers. Currently, there is some bug in the app which is causing some SMS to go to volunteers in a different zone. We are working on it and hoping to fix the bug very

quickly. Finally, it can be said that this device will serve as a protection charm for women.

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