Protibaadi$_{Next}$: A Low Cost Wearable System to Deal with Sexual Harassment in Bangladesh

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ABSTRACT
Protibaadi$_{Next}$ is a compact, low cost and power efficient wearable system that has been designed to fight against sexual harassment in developing countries like Bangladesh. The wearable device, which is connected to a safety application on the user's Smartphone, can be used to secretly disseminate *ALERT* messages along with the user's location. In this way, it helps the user to avoid danger without infuriating the harasser or having to waste time looking for the phone.

Keywords
Sexual harassment; Bangladesh; Technology Solution; Wearable Solution

1. INTRODUCTION
Sexual harassment is a severe problem which takes place in various regions and crosses economic, geographic and social boundaries. It has a traumatic impact on women's health and confidence. In developing countries up to 76% of women are subjected to sexual violence and very little help is available to them [1]. The purpose of Protibaadi$_{Next}$ is to provide women with a defense system which uses technology and connectivity to prevent and report cases of harassment.

There are existing solutions available in the market such as Smartphone applications but they are not equally popular with women worldwide as people find it threatening to bring out their mobile phones when the harasser is looking. On the other hand, commercially wearable solutions such as Vigilant [2] and Revolar [3] are expensive for people living in a developing country like Bangladesh. Therefore, it is important to provide a solution that does not draw attention of the harasser along with being cost effective, compact and power efficient.

Protibaadi, meaning defendant in Bengali, was a previously designed safety system for women which uses a wearable system to discreetly activate a Smartphone application that reaches out for help [4]. The system required improvements in order to be fully functional. Therefore, Protibaadi$_{Next}$ is an enhancement over the existing system with an improved performance.

2. SYSTEM DESIGN AND IMPLEMENTATION
The system is comprised of both hardware and software. The hardware has two segments: a *multi-vibrator circuit* trigger and a *communication module* which work together to activate an android mobile application. The *android application* receives a square wave signal from the hardware device and sends out *ALERT* messages for help. The block diagram in Figure 1 demonstrates he working procedure of the system.

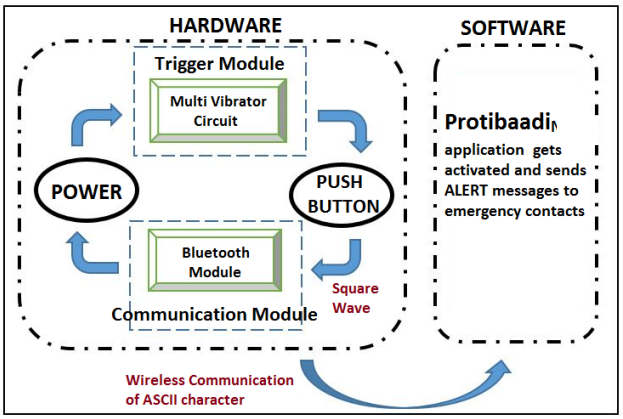

Figure 1: Block diagram of the system

Hardware Components: The multi-vibrator consists of a 555-timer, resistors (R1 and R2) and a tantalum capacitor (C1). They are used to control the frequency of the square wave signal and an on/off switch. The communication module consists of a Bluetooth module (HC-05). It pairs the wearable device with the user's Smartphone and also transfers the output of the 555-timer.

Smartphone Application: The android application is built with minimalistic features. It is responsible for receiving the output of the 555 timer corresponding to an ASCII character, via Bluetooth, and sending the user's location to her emergency contacts with an *ALERT* message. The app has also been altered from its previous version to make it compatible with the new hardware device and to control GPS activation in order to save power.

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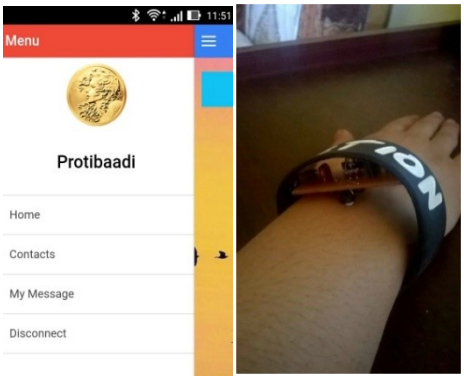

(a) (b)

Figure 2: Protibaadi App (a) and Device tentatively attached to a wristband (b)

Implementation: The multi-vibrator circuit, as shown in Figure 2(b), has a push button. When the user presses this button, the circuit is activated and a continuous square wave of a prefixed frequency and a specific length is generated. This square wave corresponds to a single ASCII character which eventually activates the Protibaadi app.

3. PERFORMANCE AND IMPROVEMENTS:

Size: The hardware components of the previous version of Protibaadi have been changed so that there is considerable reduction in the size of the device. Figure 3 demonstrates the size comparison of the new implemented device (left) and PCB layout (center) with a local coin (right).

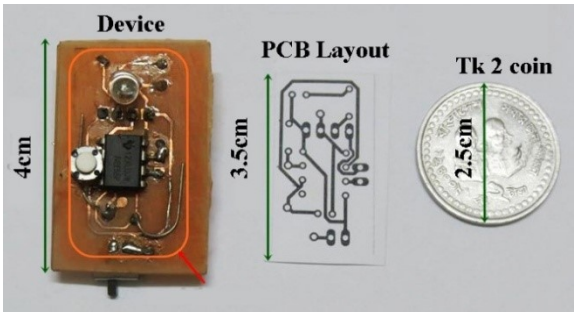

Figure 3: Implemented device (left), PCB layout (center) and local coin (right)

Power Consumption: Power consumption of the new wearable device has reduced by half due to changes in the circuit. The power consumed by each component in the previous and new hardware device is shown in Table 1.

Table 1: Total Power consumed by Protibaadi (old) and Protibaadi$_{Next}$ (new) hardware

Components	Old Device	New Device
HC-05 BT module	5A×0.035V	3.3A×0.035V
Arduino / 555 timer	5A×0.100V	3.3A×0.018V
Other components	0.075W	0.075W
Total Power	**0.750W**	**0.250W**

A considerable improvement in power consumption can be seen as Arduino is replaced by a 555 timer. Hence, the new wearable device lasts much longer without replacing the battery.

The previous Protibaadi app used to consume more battery due continuous activation of GPS to track location. Therefore, the Smartphone application has been improved so that the power consumption can also be reduced. The new Protibaadi app has been programmed to turn on GSP only whenever it will receive the signal from the hardware and it will turn it off after fetching the location. Thus, the users do not have to keep their GPS on all the time.

Cost Analysis: Breakdown of cost for building the wearable hardware is presented in Table 2 and stated in both Bangladeshi currency Taka (BDT) and US Dollar. The existing products such as Revolar and Vigilant are priced at$102.11 and $17.36 respectively. The previous Protibaadi system had a cost of $20 whereas Protibaadi$_{Next}$ costs only $6.79. Therefore, the new device is more affordable for the people in Bangladesh.

Table 2: Cost of building Protibaadi$_{Next}$ hardware

Components	BDT	USD($)
HC-05 BT module	450	5.74
555 timer	10	0.13
Battery	20	0.26
Other components	50	0.64
Total	**530**	**6.79**

4. CONCLUSION

Protibaadi$_{Next}$ is a relatively inexpensive wearable technology that is small enough to make it unobtrusive to any perpetrator of sexual harassment. With correct packaging, the hardware can be used as an accessory. The system combines the limitless powers of a Smartphone application that can send alert messages to preset mobile numbers once externally triggered. The use of the system is not only limited to women but can be used by children as well.

5. REFERENCES

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