Electronic Defense Weapon for Women Safety

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Abstract— Technology has revolutionized the lifestyle of human beings and have altered their safety in the world. Yet the safety of women in the society still remains the same. Incidents of crimes against women have been increasing at an alarming rate. Defense is the only measure that suffices against the increasing abuse. Thus this proposal describes a quick responding, independent, cost effective protection for a woman in distress. Thus this defense strategy used by females should be revolutionized with the help of modern technology and gadgets to protect them from their oppressor. Thus in this paper we intend to design and implement such a system that is portable and would ensure the safety and security of women against sexual offenders and encourage them to be independent in the society.

Key words: Distress Message; Electroshock; Fingerprint Scanner; GPS&GSM Module; Women Safety

I. INTRODUCTION

It is a distressing observation that there has been a tangible increase in the crimes against women in our country as well as all over the world. From the early time, women use various defensive strategy and ideas for their safety but are still not successful at reducing it. Newspapers are swarming with cases of women harassment, sexual assault, acid attacks and catcalling. It is very ironic that India being one of the fastest growing economy in the world fails to protect its weaker sex in the society. These social evils are becoming a major obstacle in the development of our country. From the statistical analysis from the Indian express, we can observe that the rate of crime against women are very much greater than

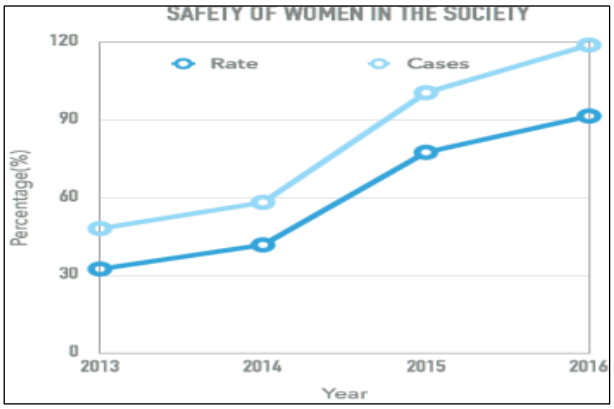

Fig. 1: Statistical data

the amount of cases that has been registered [7]. One of the major reasons for this cause is due to our culture and its integrity. However our focus and objective is to create a portable safety device that is highly secure and can be used as an immediate counter-measure to reduce the violence against women and encourage them to be independent all by themselves.

The device has been made in the form of a portable device relatively to the size of a smartphone. It is activated by an individual's fingerprint (i.e., a woman) which generates a very high voltage that is sufficient enough to incapacitate the assaulter for several minutes without causing any physical injury or death. This provides a window of opportunity for the victims to escape from the dangerous situation. Within a few seconds of activation the device simultaneously sends the co-ordinates of the location where the device is being used to the numbers (police and fed in contacts) stored in it with the help of a GSM & GPS module present in the device[2]. Since with the implementation of a fingerprint scanner the device becomes more secure and can be only used by the owner [8]. This device cannot be misused as a message is sent to the police upon activating the device. Thus providing maximum independent security and safety to the weaker sex.

II. HARDWARE IMPLEMENTATION

After extensive research and survey from the existing available technologies we have shortlisted a few components on the basis of size and practicality. The elaborate details of the components are given below:

A. Arduino Nano Board

It is a compact board similar to that of the UNO, it uses a micro-controller (ATmega 328P) with 30 pins, it operates at 5V and is powered by a 9V battery. It consists of an in-built voltage regulator that converts 9V to 5V [17].

Fig. 2: Arduino nano board

Here, we are using two nano boards, one to communicate with GPS & GSM module and other nano board communicates with the fingerprint scanner and to activate the Ultra High Voltage generator. Its dimensions are 18x45mm. It clocks at 16MHz and has a flash memory of 32Kb.

B. Fona SIM808 (GPS&GSM Module)

It is a dual functionality module consisting of both GPS well as GSM together on a single chip. It lets you add location-tracking, voice, text, SMS and data to the device in a little package[4]. The dimensions are 1.75"x1.6" which is comparatively similar to the size of a coin. It has a SIM slot at the back of the chip where it accepts only a MINI SIM(2G). It requires a 3.6V Li-poly battery to power, an external uFL passive GPS antenna and an external uFL GSM antenna for location tracking and sending the co-ordinates of the location to the stored numbers.

Fig. 3: Fona SIM808

It takes around 30s to fix the satellite location from a cold start and 1s to fix satellite from hot start[5]. It also comes with TRRS 4-pole headset compatible with any android or iPhone devices. It has 22 tracking/66 acquisition channels and accuracy is approximately 2.5 metres. The module requires a micro-controller to drive it. Any 3-5V micro-controller with UART can send and receive commands over the RX and TX pins.

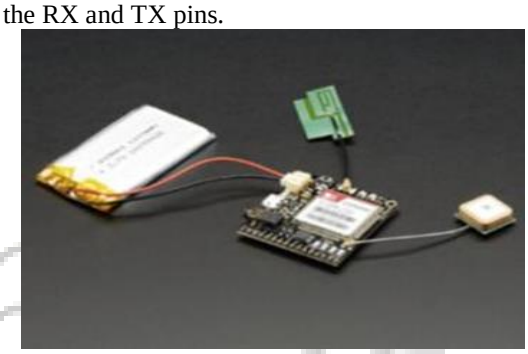

Fig. 4: Connection of antennas and battery with SIM808

C. Fingerprint Scanner

This component plays a major role in keeping this device secure to the owner. It is 37x17x9.5mm in size. The scanner consists of an optical sensor that reads the fingerprint and transmits it in the form on an image with a resolution of 450dpi. The size of the image will be of 496 bytes. The scanner can store up to 200 fingerprints in it. It is capable of 360 degree recognition and capable of 1:1 verification and 1:N identification[8]. It uses serial communication for transmitting data from the sensor to the nano board. It operates at 5V and requires a current less than 130mA. The operating time is less than a second. A 4-pin JSTSH series connector is needed to interface with the micro-controller [10].

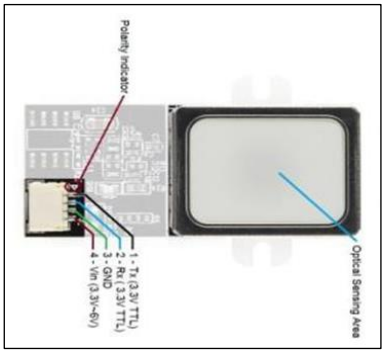

Fig. 5: Fingerprint Scanner

It has 4-pins, UART TX (3.3V),UART RX(3.3V), GND, Vin. Since the RX and TX terminals requires 3.3V to communicate, the scanner on connecting with the nano board, the board transmits 5V from the output terminal to the scanner, since the scanner only requires 3.3V at the RX pin a voltage divider circuit is used to reduce the voltage from 5V to 3.3V. The fingerprint sensor can be tested using a SDK-Demo software [12].The library for interfacing the scanner with the nano board is available in Github[11].

R1	R2	CALCULATED VOLTAGE
620Ω	1200Ω	3.3V
680Ω	1300Ω	3.28V
560Ω	1000Ω	3.21V
1k	1800Ω	3.21V

Table 1: Combination of Resistors

These are the available combinations of resistors which are given the above table. The above combinations would produce the given amount of voltages. Depending on our needs we have used a combination of 620Ω and 1.2KΩ resistor to obtain an output voltage of 3.3V [9].

D. Ultra High Voltage Generator

It is a voltage multiplier component consisting of two stages. The input of the ultra-high voltage generator is 3.7 volts and 1.3 amps. It produce a output of 15KV and 15.7 micro amps[15].The first stage is similar to the joules thief circuit[13], it consists of a flyback transformer and a transistor multiplies the low DC voltage into high pulsating voltage.

The flyback transformer is made up of ferrite core and has primary of three turns, secondary of 1k turns and feedback windings of 40 turns[14].The output of the first stage is 3 to 5 KV with current of 1 milliamps. The second stage consists of a Cockroft-Walton circuit that generates a high DC voltage from a low voltage AC or pulsating DC input. It is made up of a voltage multiplier ladder network of diodes and capacitors [16]. An output voltage of 15KV and a current of 15.7 micro-amps is produced at the ends of the terminal of the circuit. The theoretical formula used for calculations are,

$$Vo = 2NVp \qquad (1)$$

where: Vo = Output voltage
N = No. of Stages
Vp = Peak voltage

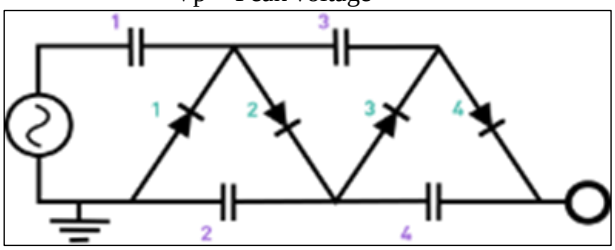

Fig. 6: Cockroft-Walton circuit

E. Battery

We are using three batteries, a 9V battery to power the two nano boards in parallel, a 3.6V battery to power the SIM808 module[5] and another 3.6V battery for the ultra-high voltage generator.

III. PROPOSED SYSTEM

The above proposed block diagram gives an idea about the design of the system and its circuitry. If the woman is subjected to an attack, then her finger has to be placed on the fingerprint sensor which is mounted on the device. On

scanning the victim's fingerprint, it sends a signals from the nano board to a transistor (TIP 120) which acts a switch and closes the circuit between the 3.6V battery and the Ultra high voltage generator.

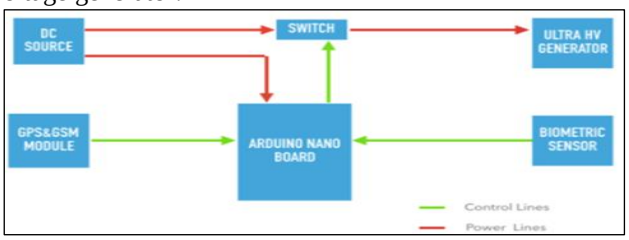

Fig. 7: Block diagram

This results in a very large magnitude of voltage (about 15kv) between two electrodes separated by a distance of half a centimeter. A bright spark is produced between the two electrodes breaking the dielectric medium between them (i.e.,air)[3].

Simultaneously, the arduino sends a signal to the GPS & GSM module which triggers the circuit to receive the location of the device through the GPS antenna and sends the co-ordinates of the location through an external GSM antenna to the numbers stored in the device[2].

IV. HARDWARE CONFIGURATION

A 9V battery is connected parallel to the two nano boards at the pins Vin and GND. Since SIM 808 and the fingerprint scanner are serial communication modules it is not possible to operate them simultaneously using a single nano board. Thus to satisfy this condition we are using two nano boards for each module [17]. The SIM808 is interfaced with a nano board separately from the other components in the device. The SIM808 module has the following pins that are being used, they are RX, TX, GND, 5V. The D2 pin from the nano board is connected to the transmitter pin (TX) and the D3 pin is connected to the receiver pin (RX) of the module [5]. A supply of 3.7V is given to the Vin pin of the SIM808 module from an external battery. Before sending the SMS the model receives a raw NMEA data from the external GPS antenna which provides us the current latitudes and longitudes of the device and an external GSM antenna sends the co-ordinates received to the stored numbers [6]. The D8 pin from the nano board triggers the module for sending SMS to the stored numbers.

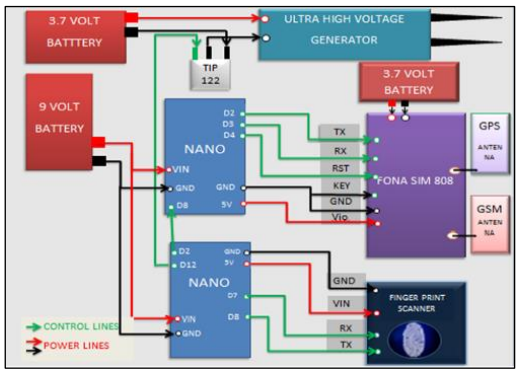

Fig. 8: Hardware Configuration

The second nano board is interfaced with the fingerprint scanner and an ultra-high voltage generator. The RX pin of the scanner is connected to the D7 pin of the nano board whereas the D8 pin is connected to the scanner's TX pin. It also uses a voltage divider circuit between the pins D7 and RX, this is because the voltage received at the RX terminal of the fingerprint scanner should be less than 3.5V, but the nano board being operated functions at 5V[9]. Thus to eliminate this ambiguity a voltage divider circuit is used to reduce the voltage being received at the RX pin of the scanner form the nano board.

The D12 pin from the nano board is used to trigger a transistor that is placed between the board and the ultra-high voltage(UHV) generator. It sends a control signal to the transistor base and a resistor is placed in between for safety purpose. This transistor acts as a switch in the circuit, and is triggered by sending voltage to the base terminal of the transistor. The negative of the 3.7V battery and the GND pin of the nano board are connected to emitter of the transistor. The collector is connected to the negative terminal of the UHV generator. The positive terminal of the UHV generator and the battery are separately connected. This is the complete hardware configuration of our system.

V. SIMULATION

The ultra-high voltage generator circuit is simulated in every-circuit simulator and the output voltage of 15 kV with current of 15.7 micro amps is verified.

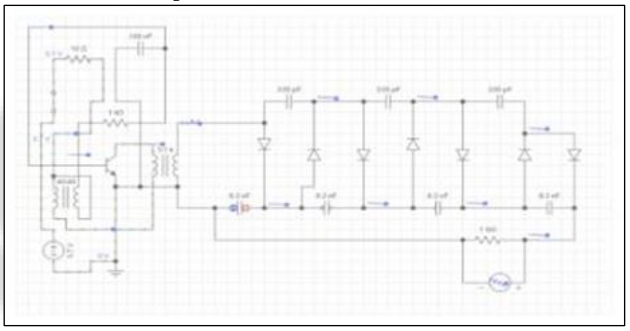

Fig. 9: Simulation Circuit of UHVG

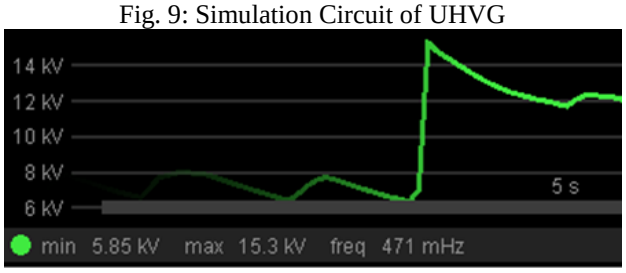

Fig. 10: Output Voltage Waveform

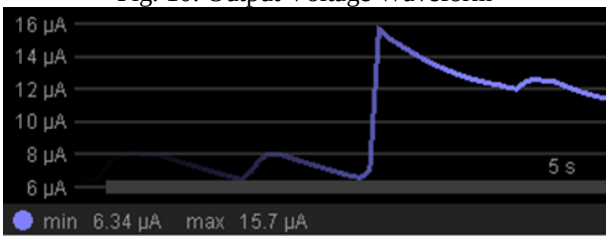

Fig. 11: Output Current Waveform

VI. SOFTWARE APPROACH

Thus the above hardware modules have been configured and the circuit for the device has been completed. The algorithm and logical sequence for the operation of our device is represented in the flowchart. The software design is done in Arduino IDE and been uploaded to Arduino Nano boards.

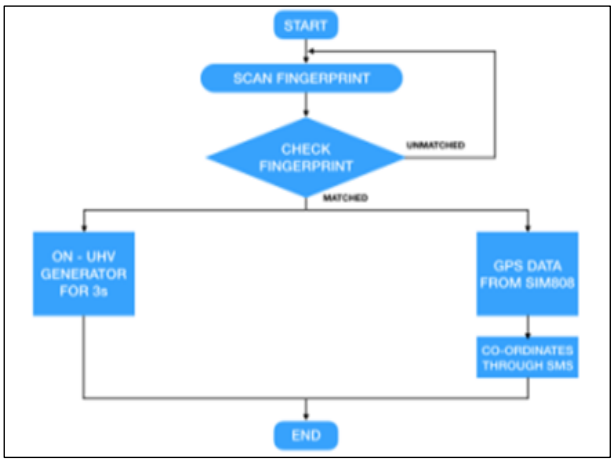

Fig. 12: Flowchart for software program approach

VII. Result and Discussion

The hardware components have been interfaced with each other using the arduino IDE. The proposed device is shown below and it is tested .It is able to recognize the stored fingerprints and the coordinates of the device is send to the stored number through SMS. The SMS consist of a link with an SOS message, on clicking the link you will be directed to Google maps which will display the coordinates of the location.

Fig. 13: Physical view of circuit

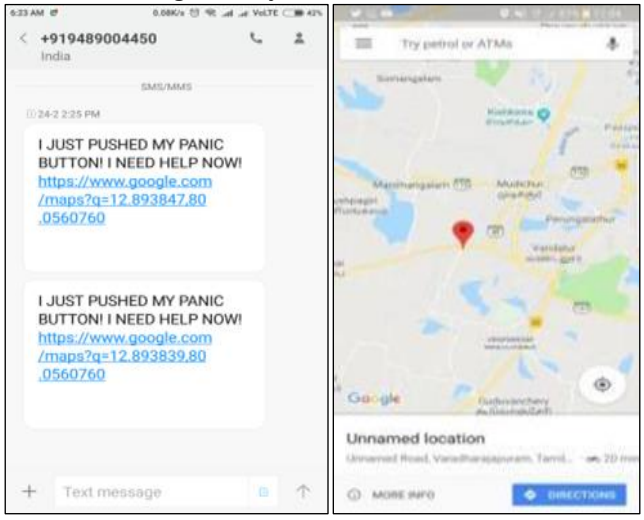

Fig. 14: SOS Message and Location of the device

VIII. Conclusion

Thus we have designed and implemented the idea as a product. This device being portable can be carried in handbags and purses. Further, with more research and study of components the entire device can be reduced to a smaller size compared to that of cellphone case. This circuit can also be implemented into watches thus increasing the ease of use and comfort.

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