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Women Safety Device with GPS Tracking and Alerts

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Abstract: ***Women safety is a very important issue due to rising crimes against women these days. Most of the women in India have experienced some form of violence or harassment in public. There is a growth in crimes related to women harassment and the main reason that a woman is being a victim is lack of public security and inability of a woman to defend her. A new approach is given towards the security of women in the form of a device. This device consists of a system that ensures dual alerts in case a woman is harassed or she thinks she is in trouble. This system can be turned on by a woman in case she even thinks she would be in trouble. It is useful because once an incident occurs with a woman she may or may not get the chance to press the emergency button. The objective of the device is to provide women with a tool that can provide them security and ensure their safety in case of any mishap. The fingerprint module consists GSM/GPS module for alerting and location tracking all interfaced with a microcontroller to design a compact device which will be handy and easily portable.***
Keywords: Security, GSM, GPS.

I. INTRODUCTION

The security of women in India has become a significant and worrisome issue, marked by a rise in crimes related to harassment and assault. The primary factor contributing to women becoming victims is the lack of public security infrastructure and the perceived inability of women to defend themselves effectively. While self-defense training is crucial, it's not always feasible for every woman to enroll in such courses due to various constraints. To address this concern, several mobile applications have been developed specifically for women's safety. However, these applications, despite their intentions, fall short of providing absolute security during critical incidents. Their functionality is often limited to alerting concerned individuals about a woman's safety, and they do not offer assistance in immediate self-defense. Furthermore, the availability of those concerned individuals cannot be guaranteed at the precise moment of an incident, rendering these applications insufficient in ensuring real-time protection. This underscores the pressing need for more comprehensive and accessible solutions to enhance women's safety in public spaces.

In certain countries, the use of self-defense equipment is considered legal. Items such as stun guns and pepper spray are designed for women to protect themselves by incapacitating potential attackers. However, these devices are considered temporary safety measures, especially when the victim requires immediate assistance or finds herself in a secluded area with no one around. It's essential to acknowledge that these tools can be misused if they fall into the wrong hands, emphasizing the need for responsible and lawful use.

To overcome the drawbacks of women security applications and self-defense equipment's, an algorithm is developed that works similarly like a security application as well as self-defense equipment. The main purpose of this device is to act as an emergency device for women who are in potential danger of being attacked. The woman possessing this device will press the panic button if in danger. An SMS containing the latitude and longitude coordinates will be sent to pre fed mobile numbers informing them of the danger and the location. The received coordinates can be viewed on google maps to determine the location of the woman and appropriate help can be provided. This concept was devised in the wake of serious crime against women in India and to help curb those crimes. To help resolve this issue I propose a GPS based women safety system that has dual security features. This device consists of a system that ensures dual alerts in case a woman is harassed or she thinks she is in trouble. This system can be turned on by a woman in case she even thinks she would be in trouble. It is useful because once an incident occurs with a woman she may or may not get the chance to press the emergency button. In a button press alerting system, in case a woman is hit on the head from behind, she may never get the chance to press panic button and no one will know she is in trouble. This system solves the problem. This device is to be turned on in advance by a woman in case she is walking on a lonely road or some dark alley or any remote area. Only the woman authenticated to the devices can start the system by fingerprint scan.

Once started the devices requires the woman to constantly scan her finger on the system by every fixed time delay, else the system sends her location to the security measure and also sounds a buzzer continuously so that nearby people may realize the situation.
In this case even if someone hits the woman or the woman falls down and get unconscious, she doesnot need to do anything, the system does not get her finger scan in fixed time delay and it automatically starts the dual security feature. This device will prove to be very useful in saving lives as Women safety is a very important issue due to rising crimes against women these days. Our system solves this problem. This device will prove to be very useful in saving lives as well as preventing atrocities against Women. It is an easy to carry device with more features and functions. The main purpose of this device is to intimate the parents about the current location of the women. A GPS system is used to trace the current position of the victim and a GSM modem is used to send the message to the pre- defined numbers.

II. COMPONENTS REQUIRED

A. Fingerprint sensor

There are many types of fingerprint scanners available in the market. The one we used for this device is calledas live scan. This fingerprint sensor is digitally processed to create a biometric template which is stored and is used for matching fingerprint of the women who uses the device.

B. Microcontroller

The microcontroller used AT mega 328p microcontroller which is a single chip microcontrollerof megaAVR family consisting a USB plug that supplies voltage of 5V. The high-performance Microchip picoPower 8-bit AVR RISC-based microcontroller combines 32 KB ISP Flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented Two-Wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. It consists 5 analog pins(A0-A5) and digital i/o pins from 2-13. The software environment used is Arduino IDE.
Parametrics:

NAME	VALUE
Program memory type	Flash
Program memory size (kb)	32
Cpu speed (mips/dmips)	20
Sram(b)	2048
Data eeprom/hef (bytes)	1024
Data communication peripherals	1-UART , 2-SPI, 1-12C
Capture/compare/pwm peripherals	1 Input Capture, 1 CCP, 6PWM
Timers	2 x 8bit , 1x 16bit
Number of comparators	1
Temperature range (c)	-40 TO 80
Operating voltage range(v)	1.8 – 5.5
Pin count	32
Low power	YES

C. WIFI module

The Wi-Fi module used is ESP8266, it's capable of either hosting an application or offloading all Wi-Fi networking functions from a processor. It helps the GPS to track the location easily and it also increases the flash disk size from 512kb up to 1mb. This Wi-Fi module is used to provide access to the WIFI network to the microcontroller.

Features:

1) *Processor:* L106 32-bit RISC microprocessor core based on the Tensilica Xtensa Diamond Standard 106Micro running at 80 MHz[5]
2) *Memory:*
- 32 KiB instruction RAM
- 32 KiB instruction cache RAM
- 80 KiB user-data RAM
- 16 KiB ETS system-data RAM

3) External QSPI flash: up to 16 MiB is supported (512 KiBto 4 MiB typically included)
4) Wi-Fi
- Integrated TR switch, balun, LNA, poweramplifier and matching network
- WEP or WPA/WPA2 authentication, or opennetworks

5) 17 GPIO pins[6]
6) SPI
7) I²C (software implementation)
8) I²S interfaces with DMA (sharing pins with GPIO)
9) UART on dedicated pins, plus a transmit-only UART can be enabled on GPIO2
10) 10-bit ADC (successive approximation ADC)

D. Power supply

It converts to 230 AC supply to necessary DC supply and distributes 5 V to each component of the device.

E. Buzzer

It's an audio signaling device once the fingerprint scan the buzzer beeps, so that the nearby people can know that the woman is in trouble.

F. GPS

GSM and GPS module are separately available in the market. As space constraint is a major issue for designinga compact device, SIM 808 is the combined GSM and GPS module. It's a navigation device capable of tracking exact location of person and send the information to the provided number to nearby police station. The required specifications of the module is shown in Table below.

Parameter	Value
Power supply	3.4V ~ 4.4V
Physical characteristics	Size:24*24*2.6mm Weight: 3.5 g
Frequency bands	SIM 808 Quad-band: GSM 850, EGSM 900, DCS 1800, PCS 1900
GPRS connectivity	GPRS multi-slot class 12 (default) GPRS multi-slot class 1 ~ 12

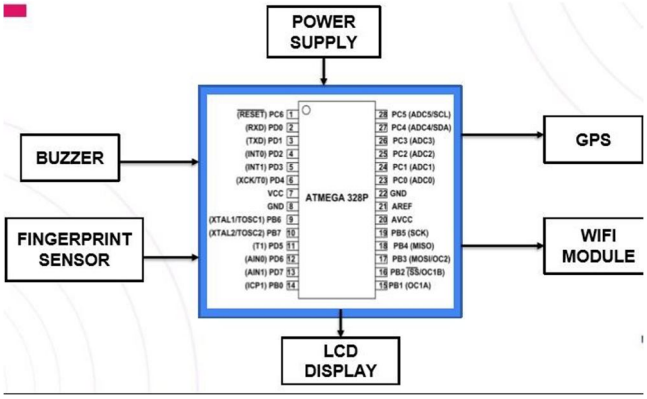
G. LCD display

The implementation involves the utilization of a 16x2 LCD display to visually present numerical information. It operates within a voltage range of 4.7 volts to 5.3 volts, with an operational current requirement of one milliampere. In this liquid crystal display, we can work both alphabets and numbers. The display module consists of rows, each accommodating sixteen characters. Every character of this board has 5 x 8 or 40 pixels The LCD operates in both four and eight bits modes, providing flexibility in data transmission and processing. An integral feature of this LCD display is its capability to illuminate the screen using a backlight with two colors, namely green and blue. This dual-color backlight enhances visibility and readability, allowing users to distinguish information efficiently.

III. SYSTEM DESCRPTION

Many women security applications have been introducedfor the safety of women as these applications have provision of informing and updating her closed ones by sending them a message with her location using GPS.

Block Diagram:



The project aims to design a Self Defense Device with fingerprint verification which on the recognition of an authorized fingerprint will generate an electric shock at the tip of the device for a particular period of time and this electric shock coming in contact with the opposition will stun the opposition for few seconds. As soon as an authorized fingerprint is recognized, an alert message with the current location of a woman will be send to her closed ones so that till the time someone comes forwardto help her, she will be self-equipped to defend herself from the danger. Fig. 1 shows block diagram of self Defense Device with fingerprint verification showing interfacing of fingerprint module, GPS and GSM module and electric shock circuit. Microcontroller ARDUINO NANO is used for interfacing and controlling with various peripheral devices.GT-511C3 is a fingerprint model to scan the fingerprint and communicate with Microcontroller using UART.SIM 808 combined GPSand GSM module is used to send the remote position to relative of woman in threat. Electric shock circuit will generate high voltage shock coming in contact with device.

A. Interfacing of Fingerprint Module with Microcontroller.

Fingerprint module selected is GT-511C3. This module has four pins viz transmission, reception, 5V input and ground. The FPR module should be operated at maximum voltage of 5V. FPR module is communicating with Arduino (AT mega 328p microcontroller) using serial communication. Before connecting FPR module with Nano software serial pins is defined using Arduino IDE software. The FPR transmission pin no. is connected directly to the pin no. 8 and reception pin is connected via a voltage divider circuit to pin no. 7. After this connection finger prints of user are stored with id number in an enrollment process. The Fingerprint modulecan store up to 200 fingerprints. The SDK software is used for the enrollment process.

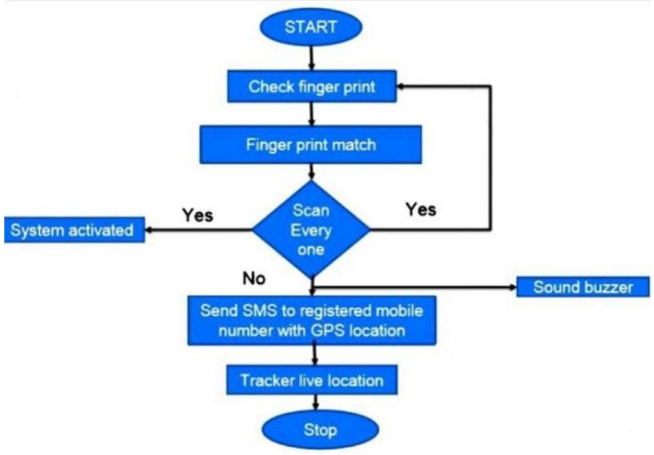
B. Interfacing GPS & GSM Module with Microcontroller

The GPS & GSM module selected is SIM 808. Thismodule integrates GSM and GPS in single module. TheSIM 808 module is connected to Nano via hardware UART pins. The transmission pin of SIM 808 isconnected to pin no. 0 (reception pin of nano) andreception pin no. 1 (transmission pin of nano). Thetransmission pin of SIM 808 is connected to pin no. 0(reception pin of nano) and reception pin no. 1(transmission pin of nano) as shown in Fig. 2.

The module requires a supply voltage of 5V-12V which is provided by the microcontroller 5V pin. The AT commands via UART of GPS are used to obtain the coordinates of the location and send this location via GSM. The coordinates are latitude and longitude values of that particular location.

IV. SYSTEM DESIGN

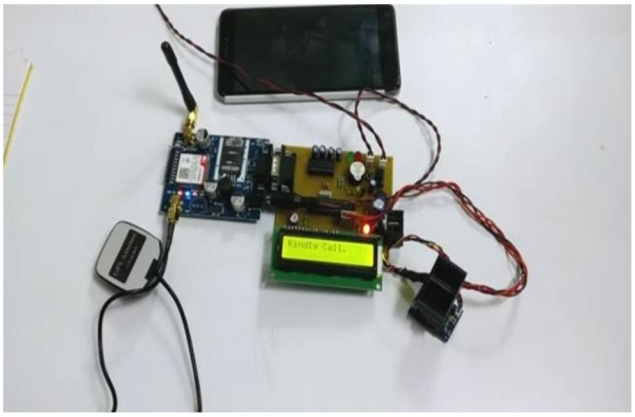
Flowchart

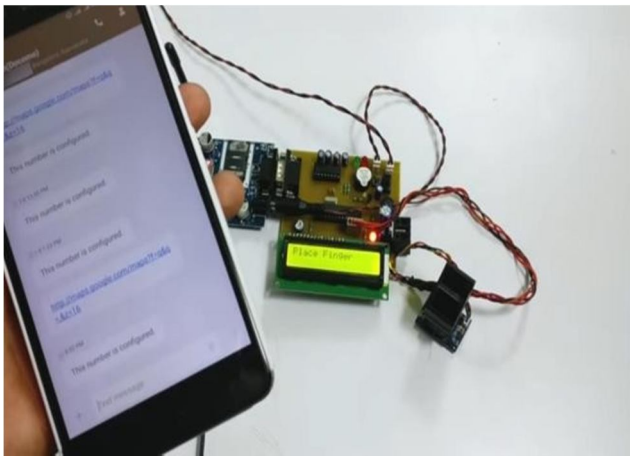


The device is designed like a portable baton. The microcontroller requires supply voltage of 3-5V. The WIFI module, Fingerprint scanner and SIM 808 are interfaced to the microcontroller. The project aims to design a Self Defense device with fingerprint verification which on the recognition of the fingerprint. Only the person authenticated to the devices can start the system by fingerprint scan. Once started the devices requires the person to constantly scan his/her finger on the system by every fixed time delay, else the system sends their location to the security measure and also sounds a buzzer continuously so that nearby people may realize the situation. In this case even if someone hits the woman or the woman falls down and get unconscious, she does not need to do anything, the system does not get her finger scan in fixed time delay and it automatically starts the dual security feature.
When fingerprint recognition is done the SIM 808 module starts extracting the location of the user through GPS module. The location is obtained in terms of coordinates of latitude and longitude. This location issent to the user's family members and nearby police station along with an alert message through GSM module.

V. RESULT

Once the fingerprint sensor sends information to LCD display, the LCD displays the process carried out and sends the information to Arduino(AT mega 328p microcontroller).. Arduino after receiving information from LCD transmits and simultaneously to the buzzer and to the provided number on the program now the provided number receives alert message once the alert messages open the message gets redirected to google mapwhich locate the exact location of the woman or a person who is in trouble. In this case even if someone hits the woman or the woman falls down and get unconscious, she does not need to do anything, the system does not get her finger scan in fixed time delay and it automatically starts the dual security feature.





This device will prove to be very useful in saving lives asWomen safety is a very important issue due to rising crimes against women these days. It is an easy to carry device with more features and functions. The main purpose of this device is to intimate the parents about the current location of the women. A GPS system is used to trace the current position of the victim and a GSM modem is used to send the message to the pre-defined numbers.
This can further be implemented in watches, key chains and belts which are easily portable. And helps in reducing crime rate and this device will prove to be veryuseful in saving lives as well as preventing atrocities againstWomen.

Advantages:

1) Safety Device which can be carried by everyone
2) It is safe and easy to use.
3) It can be used by children, teenage girls, women,old lady or old men.
4) Mobile number can be changed at any time
5) Compact in size & Wireless connectivity.
6) Low cost with high performance.
7) Works round the clock.
8) Fast response.
9) Environmental friendly system.
10) Implemented in watches, chains, torchlights etc.

VI. CONCLUSION

The device highlights a perceived gap in existing women's safety devices, emphasizing the need for an integrated solution that combines GSM/GPS alerting, location tracking, and offensive capabilities. The argument posits that current applications lack provisions for self-defense, and their efficacy is contingent upon messages being sent to the victim's contacts who then arrive at the incident location. The proposed solution introduces a Biometric Self-Defense Device with GSM Alert and GPS Tracking, touted as an optimal tool for women's self-defense. The envisioned device incorporates an algorithm that enables the victim to defend herself by delivering a high electric current to potential assailants. Simultaneously, the device sends an alert message with the victim's current location to her trusted contacts, ensuring swift assistance.
To address sudden attacks, an external button is suggested for activating the device promptly. Additionally, the proposal suggests integrating a flashlight as an auxiliary protective feature. This multifaceted approach aims to empower women with a comprehensive self-defense tool that not only alerts their contacts but also provides a means of immediate offensive response in critical situations.

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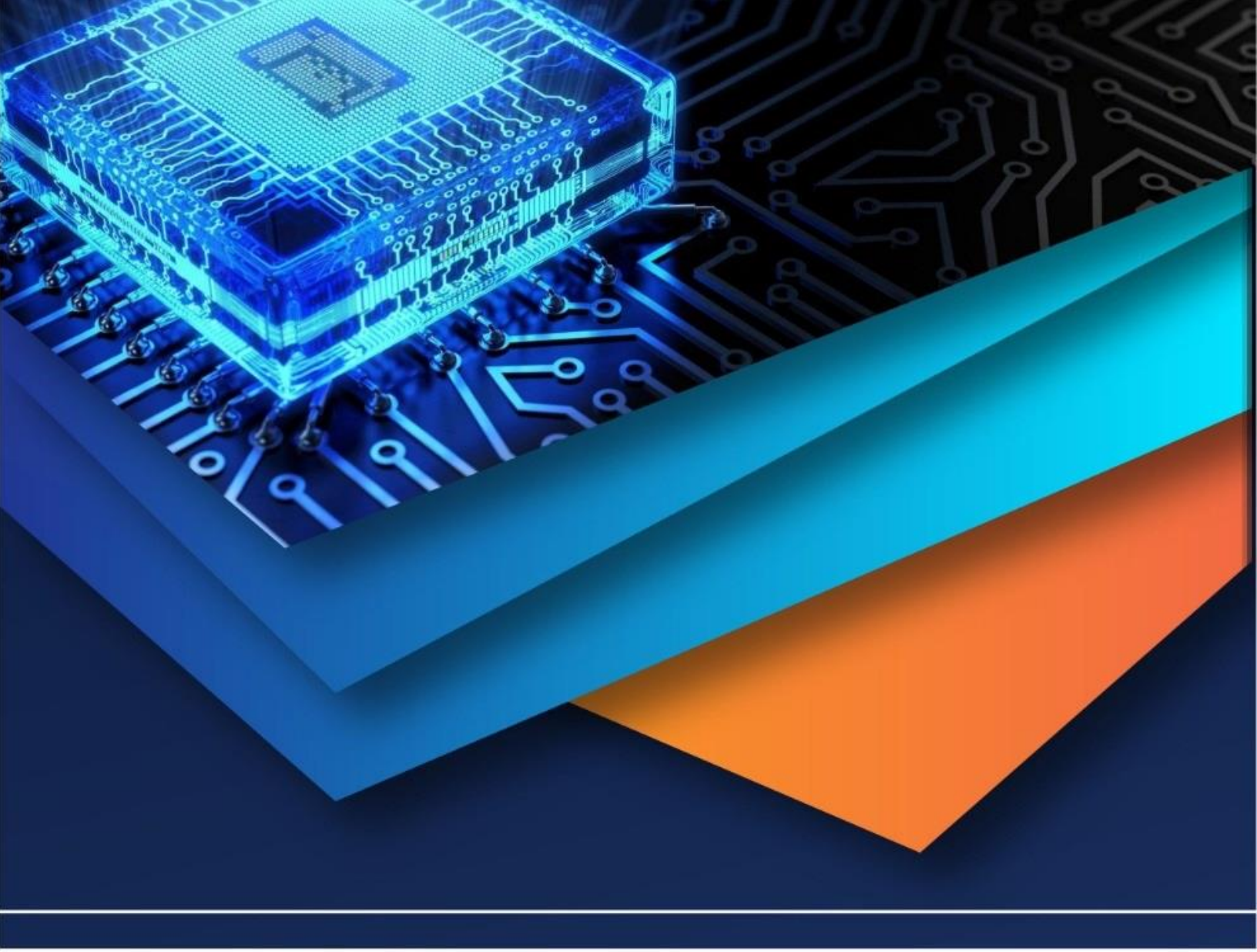

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