Smart Electronic Device for Women's Safety with GPS Tracking & Alerts

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Abstract: Women's safety is one of the significant issues due to rising crimes against women around the world. The number of cases of assault, rape, eve-teasing, and other types of crimes are rising through the years in the state, thereby making it difficult for women to pursue their dreams and late-night jobs on a large scale. To help resolve this issue we propose a GPS-based women's safety system that has an additional dual security feature in our project. This device consists of a system that ensures dual alerts in case a woman is harassed or she thinks she is in trouble. The device can be turned on in advance by a woman whenever she is walking alone in an empty street or feels she might get attacked. The idea is to design one such device which can be carried anywhere. It will consist of a button that will be easy to press when a woman is in trouble. This button will be connected to the system which has two modules, one is the GPS module and the second one is the Wi-Fi module. The first module will be sending your location to family or friends who are registered users, when she is in trouble, such that help can reach her as soon as possible. The users will receive a link in their email that will redirect them to Google Maps, containing the real-time location of the person in danger. The dual security feature will be consisting of an impact sensor such that if the person attacks a woman, the device will be able to sense it and result in a relay system activation. This system will trigger momentary shock to the culprit who's touching her and provide the woman some seconds to escape from the place. It will also trigger a buzzer sound so that the neighboring area becomes alert. The tools that we will be using are NodeMCU and GPS module for the hardware section and Blynk application for software section.

Keywords — NodeMCU, Women's Safety Device, GPS Module, Blynk App, Wi-Fi module, Impact Sensor, Buzzer, Google Maps, Relay System, Dual Security

I. INTRODUCTION

The purpose of this project is to design a compact device to help a lonely woman in danger. Our main focus is on designing a prototype so that the device can be easily integrated and carried around. As we know, women are exposed to unethical physical harassment, sometimes the culprit is left free and the woman experiences a permanent scar of absurd treatment for the rest of her life. 'Smart Electronic Device for Women's Safety with GPS Tracking' is an idea to design one such device which can be compact in size and makes an attempt to flee the woman in danger at the exact time of molestation, so she can save herself from this grave experience.
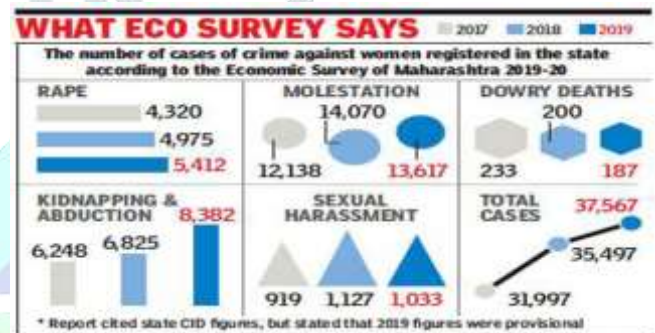

Fig. 1.1

The idea to develop a smart device for women is that it's a completely user-friendly, portable, and quick-responding model as compared to already existing women security solutions such as a separate garment, bulky e-belts, and fabled mobile apps that are just very abstract and obsolete.

If a woman is subjected to attack by an adversary, then a switch has to be pressed by her manually, which in turn will trigger the NodeMCU to activate the GPS Tracker and here we are attempting to Global Positioning System (GPS) receiver which will acquire the location co-ordinates of the woman subjected to attack and will send these to the pre-registered email IDs (typically the family or in VIP case: the police), via Android Application.

II. EXISTING SYSTEM

Having the concern of women's safety in mind, many developers have come up with solutions: Emergency Codes like *91# which can be used to provide emergency services, which will alert police control. Another free mobile application 'Help me on mobile' to ensure the safety of women was launched to assist women in danger. Such applications needed a single click to initiate the system. But when a girl is in trouble, there is a risk of failure of the girl not capable of taking the phone and tapping the desired button.

SHE (Society Harnessing Equipment): This is one garment that's embedded with an electronic device that gives out 3800kV electric shock to the culprits thereby allowing the victim to escape. But it comes with great costs and also can result in false alarms if someone other than the culprit mistakenly pushes her.

Smart Belt: This system is developed with a portable device that almost resembles one simple belt. The basic components present in this system are the Arduino board, screaming alarm, and pressure sensors. But is quite expensive.

Watch Over Me is an application that transforms the phone into a personal safety device. It monitors the start-to-end journey and alerts the contacts if the woman has not reached the destination within the scheduled time. But there can be cases when she is late due to traffic and many other reasons, leaving unrequired stress to the registered relatives.

Witness: Using Witness, women can broadcast their location, audio, and video to registered contacts in just one touch. In addition to sending calls and texts to emergency contacts, it will broadcast live video, audio, and live location. But it will not help to tackle the real-time situation.

The above-mentioned applications are just a few examples of safety and security devices implemented but have some little faults which will be taken care of in this project.

III. PROPOSED SYSTEM

This women's safety device is a special security system which is in an LCD Display and Button form. It will be attached to the clothing or purse or the bag which the woman carries with her to do day to day activities and when the button is pressed it performs the action of alerting contacts including the registered family member or friend in the BLYNK (software application). This application would also help the system undergo the proper authentication process. The device enabled with the GPS system will be able to send the location to the contacts. This location will be sent through a link on the e-mail of the registered person(s). This link will redirect us to the Google maps showing the exact location of the victim in danger. The figure below illustrates a brief block diagram about the system to be implemented.

Here the trigger will be button press which will activate the Node MCU which consists of Wi-Fi module which helps us to send the location which is tracked by GPS to the selected phone numbers.
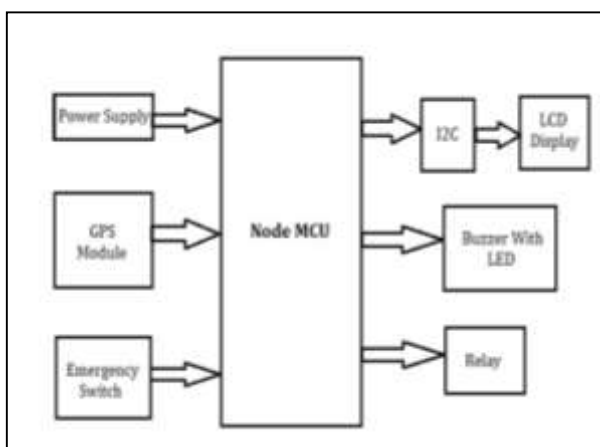

Fig 3.1

The following steps define the working of this safety device:

i.   The system is turned ON when switch is pressed in instances of attack, manually by the woman.
ii.   This switch triggers a microcontroller (Node MCU) that activates an on-body alarm.
iii.   This Switch also initializes the BLYNK application through which we can register the woman and also the contact numbers and emails of the closest relatives.
iv.   The microcontroller triggers the GPS module & I2C for serial communication between LCD display and NodeMCU.
    Emergency Switch for emergency situations:
v.   Hand-held controller when triggered, receives location coordinates from the GPS receiver and transmits these in the form of an email to the pre-registered email ID.
vi.   Relay with shock provider is connected to the switch and gets activated and provides shock to the person molesting the woman.

IV. MODULE DESIGN

This system functions with 4 different modules. They are
i.   WIFI Module
ii.   GPRS Module
iii.   Emergency switch
iv.   Buzzer with LED
v.   Shock Provider attached through Relay

The first step is location tracking. This tracking system is the most significant part of this project since it makes sure that help and evidence is on the way for the victim. Hence, it is required to be faster and efficient. This system will update the location of the victim continuously to the registered email ID. It can also be sent through SMS.

The programming is done in such a way that the latitude and longitude of the place of victim is accessed and sent at multiple instances and at different pre-set times. This location is updated through a timeout of 10-15 sec and will be sent through software application BLYNK. The most convenient form to inform about location is a Short Message Service (SMS) as cell phones are widely used. But these messages are sent through the WI-FI module which will be connected to the mobile hotspot.

The location tracking subsystem will initiate its working once a trigger is given by the user. On parsing the correct reading, the micro-controller commands the WIFI module through Node MCU to transmit the data through an SMS by using AT commands. The woman first has to register herself in the BLYNK application to access the device. Once the button is pressed by the women it triggers the Node MCU to send SMS through Wi-Fi module. I2C is used for serial communication between LCD Display and Node MCU for typing quick messages.

The alarm module is secondary module which will be triggered with two button press. On the first time when trigger is given, only the location will be sent. If the user feels threatened or needs emergency assistance, then all that has to be done is simply activate this Emergency Switch. It will catch the attention of others for immediate help with the help of Buzzer with LED.

The BUZZER will sound for the specific time period and then cease. Especially useful for women while traveling alone as it is small enough to pocket or carry in a hand bag. A relay with a shock provider is connected to the switch such that the if the women is constantly getting touched, pushed or pulled with force, then the relay gets activated and provides shock to the person touching her.
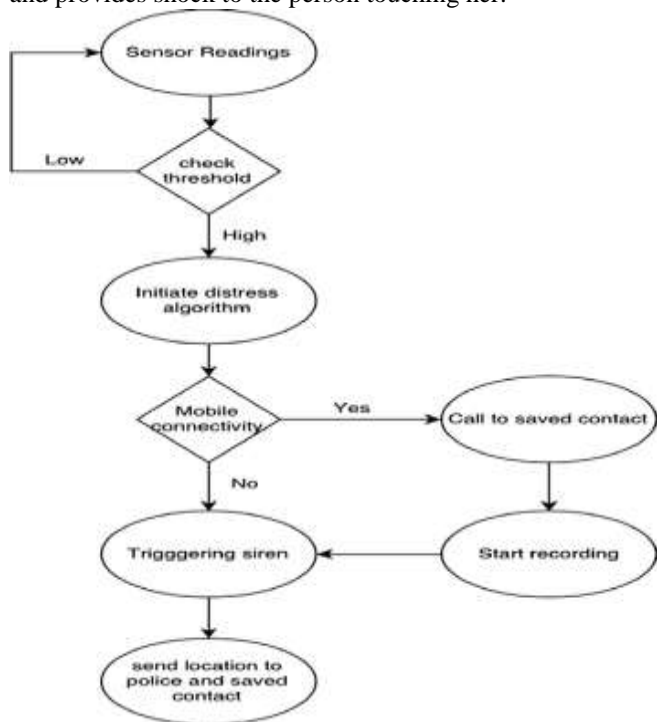

Fig. 4.1

V. HARDWARE SPECIFICATION

5.1 WI-FI Module

The NodeMcu is a very well-known firmware and development kit, which is also an open-source kit. This will help to Prototype an IOT product within a few Lua script lines.

5.1.1. Features:
i.   Open-source
ii. Interactive
iii. Programmable
iv. Low cost
v.   Simple and Smart
vi. WI-FI enabled

5.1.2. Specifications:
This Development Kit is based on ESP8266, which is also capable to integrate many other components in one. Such components include GPIO, PWM, IIC, 1-Wire, and ADC all in one board.
i.   USB-TTL included, plug &play
ii. 10 GPIO, every GPIO can be PWM, I2C, 1-wire
iii. FCC CERTIFIED WI-FI module
iv. PCB antenna

5.2 Global Positioning System (GPS) Module:

A GPS-enabled device can retrieve longitude and latitude information about the location in all weather conditions, anywhere on the surface of the Earth. System requirements include an unobstructed line of sight to four or more GPS satellites. In exceptionally poor signal conditions, such as in urban areas, satellite signals may be subject to an exhibition of multipath propagation. Here, signals will bounce off structures or can be weakened by some extraordinary meteorological conditions.
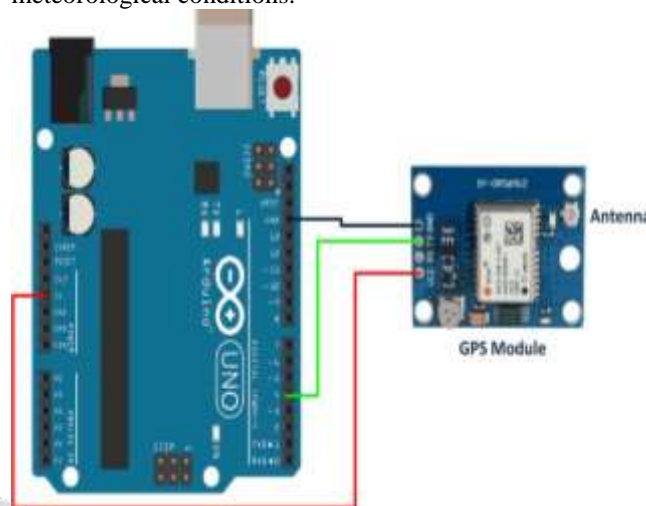

Fig. 5.1

5.2.1. Specifications required to attain perfection:

i.   Satellites: 22 tracking, 66 searching
ii.   Patch Antenna Size: 15mm x 15mm x 4mm
iii.   Update rate: 1 to 10 Hz
iv.   Position Accuracy: 1.8 meters
v.   Velocity Accuracy: 0.1 meters/s
vi.   Warm/cold start: 34 seconds
vii.   Acquisition sensitivity: -145 dBm
viii. Tracking sensitivity: -165 dBm
ix.   Maximum Velocity: 515m/s
x.   Vin range: 3.0-5.5VDC
xi.   MTK3339 Operating current: 25mA tracking, 20 mA current draw during navigation
xii.   Output: NMEA 0183, 9600 baud default
xiii. DGPS/WAAS/EGNOS supported
xiv.   FCC E911 compliance and AGPS support (Offline mode: EPO valid up to 14 days)
xv.   Up to 210 PRN channels
xvi.   Jammer detection and reduction
xvii. Multi-path detection and compensation

The GPS has a built-in real-time clock, which is possible to keep a track of time even when its power is lost. It can also help reduce fix times, if one expects to have a flakey power connection.

5.3 Buzzer

A buzzer is used to add sound features to our system. It is a very small and compact 2-pin structure that can be easily used on a simple breadboard, Perf Board, and ultimately on PCBs. This makes it a widely used component in most electronic devices or systems. In our system, it will trigger a loud buzzing sound when a woman is in danger and presses the button to alert her surroundings as well as the culprit.

5.4 LED

A light emitting diode is a simple and small electric component that emits light when the electric current flows through it. The LED's role in the system is to indicate the switch on and switch off condition of the device to receive

the working status of the system. Further functioning will be fed by Arduino coding and will be integrated into the device.

5.4.1. Specifications:

i.   Rated Voltage: 6V DC
ii.   Operating Voltage: 4-8V DC
iii.   Rated current: <30mA
iv.   Sound Type: Continuous Beep
v.   Resonant Frequency: ~2300 Hz
vi.   Small and neat sealed package
vii.   Breadboard and Perf board friendly

VI. SOFTWARE SPECIFICATION

6.1. Arduino Programming

The software used for training the device and integrating with the microcontroller is the Arduino Integrated Development Environment (IDE). This provides a hustle-free platform for programming the microcontroller. Several delays are included so that the respective modules get a green light to initialize themselves and synchronize with the networks.

6.2. Application Used to receive location

Blynk is a free application that allows quick and user-friendly interfaces to build, control and monitor a hardware system from any iOS and Android device. After downloading the Blynk app, a project dashboard is produced which can be customized by arranging buttons, sliders, graphs, and other widgets onto the screen as per the system's requirement. Using these widgets, a user can easily turn pins on and off. It can also display data from sensors if needed.

The Blynk application is used in our project to get the exact location of device on the registered person's email ID.This application can also be used to fetch location of the woman carrying the device anytime by pressing the ON button. Since this application continuously interfaces with NodeMCU and data is stored at main Blynk server, the location will be sent via email whenever the registered person demands it. This makes it user-friendly on both sides of the system.
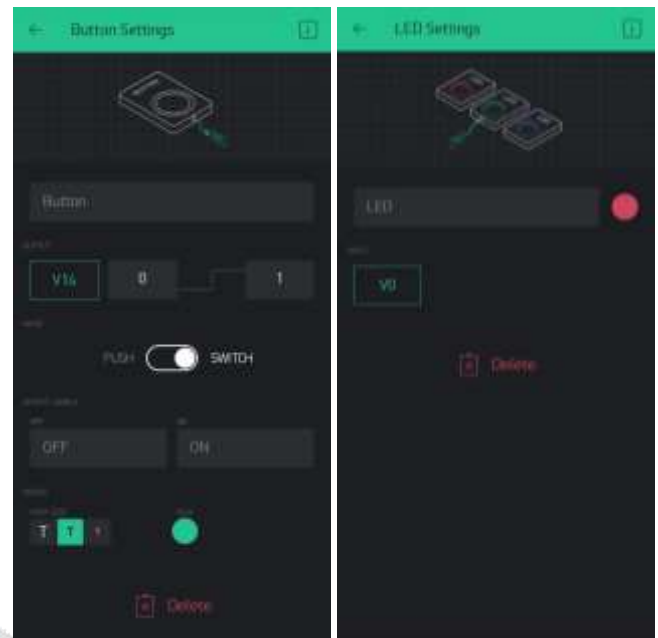
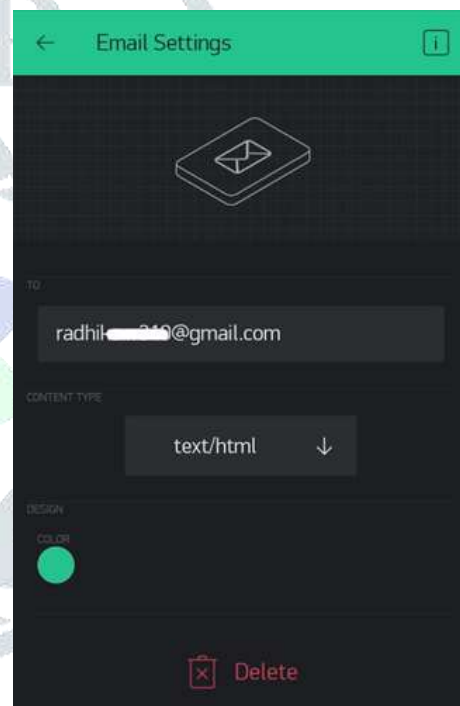

Fig 6.1

Fig.6.2

Fig. 6.3

VII. CONCLUSION

Smart Electronic System for Women Safety 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. 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 following are the results obtained.

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