WOMEN SAFETY SYSTEM USING ARDUINO NANO AND GPS MODULE

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Abstract: Ensuring the safety of women in society is a crucial issue, and leveraging technology can play a significant role in achieving that goal. An example of utilizing technology to enhance women's safety is the implementation of a GPS-based system. Specifically, a women's safety system equipped with a GPS module has been designed to provide assistance to women in need. This device incorporates a GPS module to track the woman's location and, in case of emergencies, promptly notify a designated emergency contact. Activation of the system can be initiated through a smartphone app or a dedicated button on the device. By utilizing satellite signals, the device's GPS module accurately determines the woman's position while also offering communication capabilities.
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Index Terms – **Arduino Nano, GPS, GSM Module, Vibration Sensor, Proteus, Stimulation, Arduino IDE**

I. INTRODUCTION

Women play a major role in society as equal to men. It is pathetic that in this modern era too, there is still a threat to women's safety in most of the countries in the world. [20]. Although with the strong criminal punishing laws, it's sad that the safety measures taken are not hundred percent effective. Adding to this, we can't change the mentality of all humans. to build confidence and a sense of safety in women, an effort has been made to build a project that creates a safer environment for women wherever she wishes to perceive.

A tool created to assist women in need is a women's safety system. It is a wearable gadget that tracks the woman's whereabouts and, in the event of an emergency, sends a message to a saved emergency number using electronic components such GPS modules, microcontrollers, sensors, and wireless communication modules.

The gadget can be started by either pressing a button or using an app on a smart. The device's GPS module uses satellite signals to pinpoint the woman's whereabouts, and it can also connect to the mobile network to exchange extra location-related data.

In the present era, ensuring the safety of women has emerged as a critical concern due to the prevalence of physical and sexual abuse. This unfortunate reality creates an atmosphere of fear and restricts their ability to freely navigate public spaces. Despite notable technological progress, women and girls in numerous locations still encounter a range of challenges, with a distressing number becoming victims of physical and sexual violence on a daily basis.

A wearable security device designed for women's blazers contains an embedded microcontroller, emergency switch, GPS receiver, GSM modem, buzzer, shock circuit, and voice recorder. The device can alert parents and police of the user's currentlocation via text message in case of an emergency. The device captures GPS location information, which is then used to generate a message containing location information and sent to the police and a pre-programmed mobile number. The GPS location can also be tracked on Google maps, allowing users to feel safe and secure.[20]

When a woman feels unsafe, she can activate the system by using the fingerprint sensor. This triggers the system to send the woman's real-time location and a message to her registered contacts to inform them that she is in danger. To avoid triggering the system and alerting the police and family, the victim needs to make sure to sense her finger on the sensor at least once a minute. The use of IFTTT applets guarantees the automatic sending of SMSs in response to a triggered IF condition. Additionally, the micro-controller activation allows the camera to take pictures. By utilizing these technologies, we can improve the safety of women.[17]

One of the most prevalent criminal offenses in the country currently is sexual harassment, which is increasing at an alarming rate. Women are known for their ability to mobilize people from different backgrounds, such as ethnic, religious, political, and cultural, for a common goal of promoting freedom.

Recognizing the crucial importance of women's safety, it is imperative to ensure their adequate protection. Regrettably, schools often overlook imparting basic life skills, including essential safety precautions, while working hours can extend into late evenings or involve night shifts. Consequently, numerous sectors are advocating for the implementation of projects that teach young girls self-defense techniques.

One potential approach to address this issue involves the utilization of an emergency device designed to safeguard women at risk of assault. Given the global concern regarding women's safety, novel and creative solutions are sought to address this problem. A promising concept involves a women's safety system incorporating Arduino and GPS technology. This project focuses on developing a simulation to evaluate the system's performance across different scenarios, including emergencies and areas with weak signal strength.

The system comprises a GPS module and an Arduino microcontroller, enabling location tracking and communication with a mobile app. The app offers a user-friendly interface for activating alarms, accessing alerts, and monitoring the individual's location in distress. Through this simulation, the aim is to enhance the overall quality and reliability of the women's safety system in a cost-effective and efficient manner. Thoroughly testing the system's effectiveness in diverse situations is crucial to ensure women's safety. The project aims to contribute to the development of innovative solutions in addressing this significant issue.

II. LITERATURE SURVEY

This paper proposes a security system designed to enhance women's safety and provide essential security measures. The system incorporates various colorful modules such as GPS guard (SIM900A), Atmega328 board, Arduino Board, GPS module (GYGPS6MV2), Screaming alarm (ADR 9600), Pressure detector, and power force unit [1].

In this paper[2], an attempt is made to design a device named "Suraksha" to immediately alert the cops near the location from where the device is activated. which indeed provides worthy evidence against the crime.

In this paper, the authors have made an advancement in the present existing device which could send an emergency message to the contacts feed by the user. when the attacker or the culprit touches the watch a shock is induced which tends the attacker to let go of the victim [3]..

This paper presents wearable detector bumps that incorporate solar energy harvesting. It provides information on various detectors utilized for monitoring the health data of individuals. Additionally, the authors have developed an online platform to manage the collected data from the detectors [4].

In this paper, the authors uniquely try to develop a wearable smart band with an additional secret webcam to record important information and it is connected to Bluetooth [5]. Along with that the device also tracks the health of the person wearing it and monitors it using the device that's been connected. when the SOS button is pressed continuously having less or no delay, a message goes to the authorized person stating the person is in danger

In this paper, the author describes their endeavor to create an Android application that triggers a vibrate detector upon launching the app. Additionally, whenever the user interacts with the phone's screen, the GPS and GPS module become active and capture the latitude and longitude coordinates, which are then transmitted to the application. The application forwards these values to the registered contacts specified by the user, ensuring the safety of women [6].

The proposed work focuses on designing and developing an electronic device that can automatically record instances of chain snatching, a criminal offense. However, it should be noted that this system has a limitation as it is only effective within a specific range [7].

Ensuring the safety of women has become an increasingly crucial issue in today's world. With the rise in night shifts for women in the IT industry, there is a pressing need for security solutions. This research paper presents a model that addresses the security concerns faced by women working during nighttime by incorporating features such as location tracking, self-defense mechanisms, and instant alerts. Additionally, the proposed system includes a health monitoring component to keep track of vital signs like heart rate and body temperature [8].

Every single day, women of all ages and backgrounds face the daunting challenge of ensuring their own safety and shielding themselves from the unwelcome attention of insensitive individuals who engage in acts of molestation, assault, and the violation of their dignity. Unfortunately, public spaces, including streets and transportation systems, have become hunting grounds for these predators. Given the prevailing circumstances of these distressing offenses against women, a proposal is put forth for a smart wearable device based on the Internet of Things (IoT) that aims to enhance women's security. This device takes the form of a compact and portable smart ring, referred to as SMARISA, and consists of components such as Raspberry Pi Zero, a Raspberry Pi camera, a buzzer, and an activation button. In the event of an assault, the victim can simply press the button on the ring, immediately capturing the assailant's image using the Raspberry Pi camera and retrieving the victim's current location. The captured image and location data are then transmitted to predetermined emergency contact numbers or the police via the victim's smartphone. This innovative approach eliminates the need for additional hardware devices or modules, ensuring a compact and efficient security solution. [9].

In this paper "An Energy Harvesting Modelling and Profiling Platform for Body Sensor Networks" to monitor, record, analyse the person psychology, the behaviour characteristics of a person and environment change in indoor and outdoor actions are analyse by wireless sensor device [10].

A social-government organization, a distressing 35% of women worldwide endure various forms of physical harassment in public spaces such as train stations, bus stops, sidewalks, and schools. Our collective aspiration is for a future where every woman can freely navigate the world without any fear. With this goal in mind, our focus shifts to personal security. This research paper primarily delves into the design and implementation of a prototype electronic device that holds the potential to serve as a safety wearable in the coming years. The device incorporates a pulse sensor to monitor abnormal health conditions and utilizes GPS technology to periodically send the user's location to emergency services, such as an ambulance, via SMS every 15 seconds. The GPS receiver retrieves location data, including latitude and longitude, from satellite signals. [11].

Proposed paper "An Energy Harvesting Modelling and Profiling Platform for Body Sensor Networks" says about a jacket which has an electronic system built in it, using Raspberry Pi 3, GPS and Buzzer [12].

In this paper [13], authors has worked on a device that supports micro USB charging. To complement the smart band, a dedicated Android application will be developed, connecting to the device via Bluetooth interface and displaying the collected data from the user to the designated ICE contacts. As long as the device remains active, it will continue to send location updates at five-minute intervals and emit continuous beeping sounds.

The combination of Internet of Things (IoT) and cloud computing presents a viable solution to tackle the pressing issue faced by women in our country. Our proposed system leverages IoT technology to create a women's safety system specifically designed to address various untoward emergencies that women may encounter. This device incorporates features that enable immediate alerts in situations where a woman is harassed or feels threatened. By ensuring real-time messaging and live tracking of her location, swift action can be taken to prevent crimes against women [14].

This paper, they've created a device containing three drive buttons are used to define the different feathers of accident victims. A PIC16F887A microcontroller is used to control the entire system. Because it's a 40- leg IC, the device increases in size, making it delicate for women and children to carry all of the time [15].

This research paper presents a touch-triggered system aimed at enhancing women's security using GSM technology. It serves the purpose of identifying threats and providing immediate access to resources for assistance in dangerous situations. When a person detects danger, they simply need to press the button on the device. The system consists of an ATmega328 microcontroller, GSM module, and GPS module. Upon activation, the system tracks the location of the woman using GPS (Global Positioning System) and sends emergency messages and calls to both relatives and the police control room using GSM (Global System for Mobile communication). One significant advantage of this system is that it does not require a wireless network, unlike many previous applications. The utilization of these components ensures accuracy and reliability. The system encompasses all the necessary features to aid the victim in various emergency scenarios. Additionally, the inclusion of a safety device that alerts the victim's family members can contribute to a stronger sense of security, confidence, and reduce the chances of harassment. This project offers a solution to protect women by incorporating a wireless key GSM module with a controller. When a woman feels uneasy, she can press the button to activate the GSM module. The GSM module will then send an SMS containing the latitude and longitude coordinates to the designated number. [16].

In this paper [17] a proposed device is designed "A safety system for women using android application" which activates the vibrate sensor when open this application.

The main working of this device Pro-Tech-Implementation is based on the fast booming technology called IOT for women safety to provide self-defense device, this device produces a shock to the attacker [18].

The project is titled "Android App for Women Security System." It utilizes Java SE 7 Software Development Kit as the front end and SQLite as the back end. With the widespread usage of smartphones in today's world, they can be effectively utilized for personal security and protection purposes. Given the significant concern surrounding women's security, this Android application aims to mitigate potential threats they may face. By activating the app with a single click, the associated individuals can be alerted. The app uses GPS to identify the user's location, and a message containing the location URL is sent to the registered contacts, providing assistance in dangerous situations. Continuous location tracking information sent via SMS enables quick location retrieval, ensuring the victim's safe rescue. [19].

This paper, they Design of women safety and security using the device where they use a voice recorder which has a pre-recorded sentence "Help I am in danger" by the user [20].

III. PROPOSED MODEL

In the proposed concept, the stimulation of women's safety system using Arduino nano, GPS, GSM, relay module, vibration sensor, switch, and LCD display. This system includes many inbuilt functions from Arduino nano.
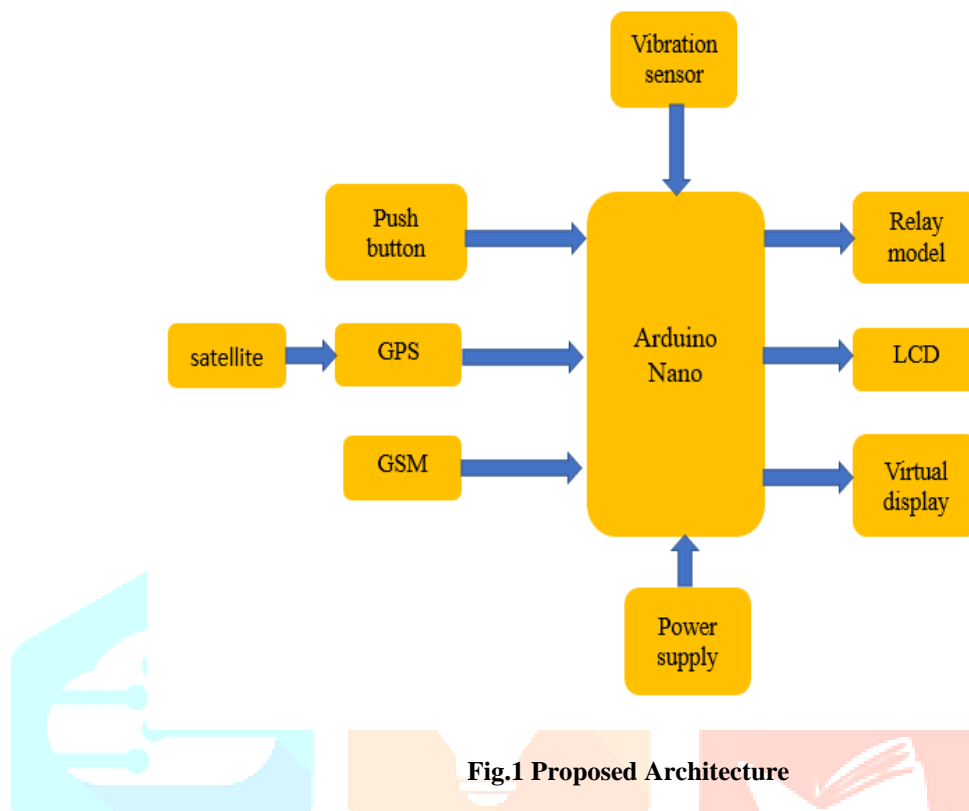

Fig.1 Proposed Architecture

The system's design consists of the following steps:
Step 1: Write a program in embedded C according to the problem statement.
Step 2: Convert the .c file to .hex file by exporting the program to binary code.
Step 3: Create a .hex file for all the modules.
Step 4: Add respective .hex file to each module.
Step 5: Start the simulation by clicking the play button.
Step 6: Check for the status of SOS button Status.
Step 7: Send the alert message and GPS Coordinates along with the message "I'm in trouble" to the concerned phone number.
Step 8: If the status of the button is closed then notify by stating "I'm OK."

IV. METHODOLOGY

Once the circuit setup is done, each component should be added with its .hex file. A hex file pertaining to a GPS module is typically a firmware or software update file that contains hexadecimal code used to update the module's firmware. Hexadecimal code is a representation of binary data in base-16 format.

When working with an Arduino Nano and a GPS module, the term "hex file" refers to a compiled binary file that contains the machine code required to program the Arduino Nano microcontroller. To achieve the goal of sending the GPS location when a button is pressed, you would need to develop or find an Arduino sketch (code) that incorporates the necessary libraries for the GPS module and button input.

The Arduino sketch would define the behaviour of the Arduino Nano when the button is pressed, including reading the GPS coordinates and transmitting them to a designated destination. Once the sketch is ready, you can use the Arduino Integrated Development Environment (IDE) to compile the code, generating a hex file. This hex file contains the machine code that can be uploaded to the Arduino Nano to execute the desired functionality.

It's essential to consider that the specific implementation and code will vary depending on the GPS module, button input, communication protocol, and destination you intend to use for transmitting the location data. Consequently, you must tailor the code or find suitable code that fits your specific hardware and requirements. Compiling it using the Arduino IDE will produce the corresponding hex file, enabling you to program the Arduino Nano accordingly.

Further, add hex file for gps module, when updating the firmware of a GPS module, one would typically acquire the appropriate firmware file (often in the form of a hex file) and employ a manufacturer-provided tool or software to transfer the hex code to the module. This process enables bug fixes, feature enhancements, or performance improvements for the GPS module.

It's worth noting that the content and structure of a hex file for a GPS module can differ based on the manufacturer and module model. The hex file is designed to be compatible with the module's programming interface, facilitating the flashing of the code onto the module's memory.

If you possess a GPS module and need to update its firmware, it is advisable to refer to the manufacturer's documentation or seek their support for instructions on acquiring the correct hex file and conducting the firmware update process specific to your module.

When referring to a GSM module, a hex file typically represents a compiled binary file containing the machine code necessary for programming the module. However, to enable the functionality of sending an SMS when a push button is pressed, you would need to acquire or develop specific code or firmware designed for your particular GSM module.
To implement this functionality, you would typically create or find an Arduino sketch or code that incorporates the required libraries for the GSM module and button input. This code would define how the GSM module behaves when the button is pressed, including initializing the module, establishing a cellular connection, and sending an SMS message with the desired content to a designated phone number.

After preparing the Arduino sketch or code, you can compile it using the Arduino Integrated Development Environment (IDE), resulting in the generation of a corresponding hex file. This hex file contains the machine code that can be uploaded to the GSM module, enabling it to execute the desired functionality.

It is important to note that the specific implementation details and code may vary depending on the GSM module used, the button input method, and the specific GSM library employed. Therefore, you must ensure that you obtain or develop the appropriate code that matches your GSM module and requirements. Compiling this code with the Arduino IDE will produce the corresponding hex file, allowing you to program the GSM module accordingly.

When it comes to a vibrator sensor used to activate a system upon pressing a button, the concept of a "hex file" does not directly apply. Typically, a hex file contains compiled binary code used for microcontroller programming or firmware updates.
However, to achieve the desired functionality with a vibrator sensor and a push button, you will need to develop or obtain specific code or firmware that is suitable for your system.
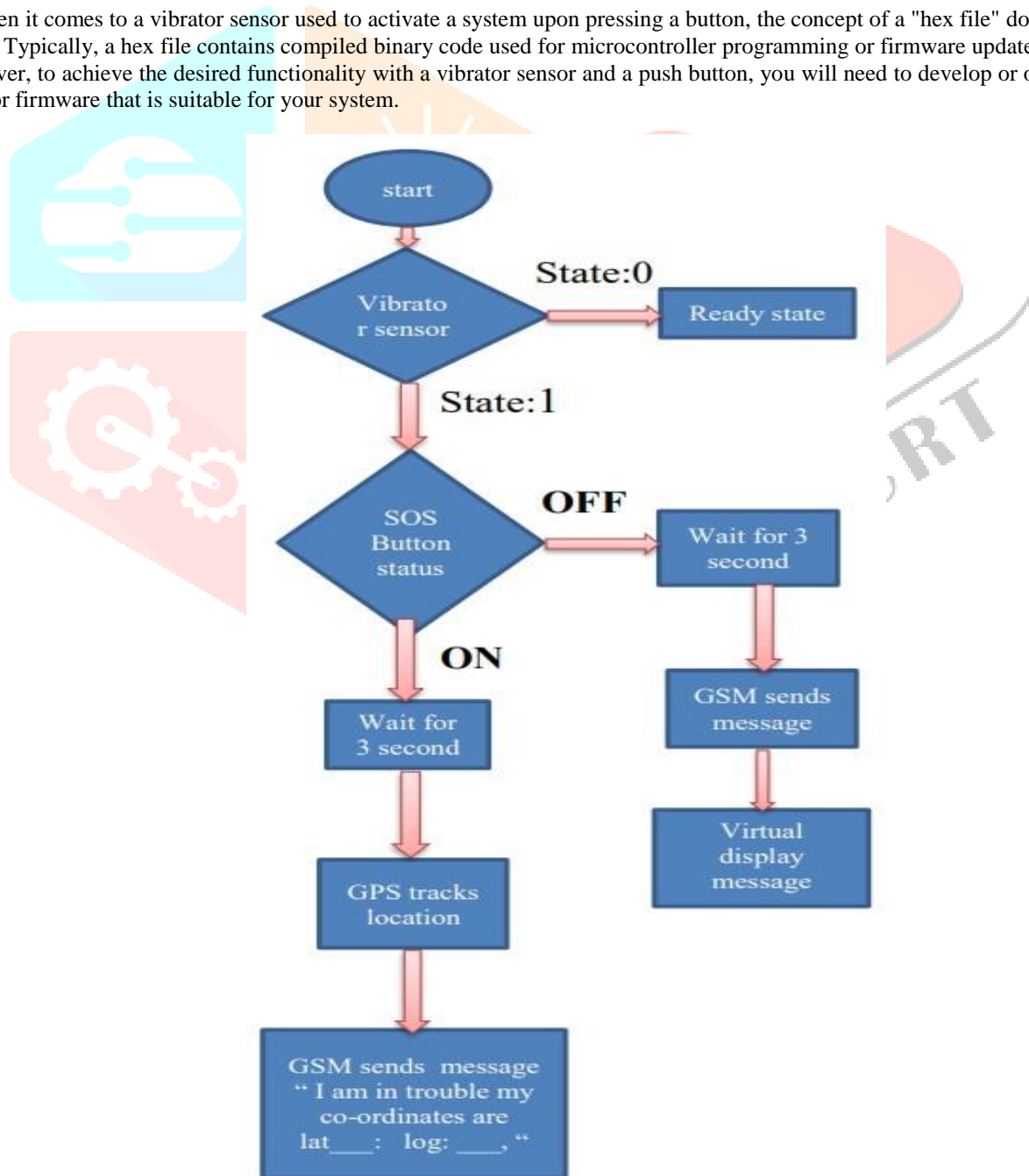

Fig. 2 Flow Chart

Usually, you would create or find the appropriate code or sketch that integrates the required components, including the vibrator sensor and the button input. This code would define how the system behaves when the button is pressed, such as activating the vibrator sensor or triggering a particular response.

Unlike a hex file, the code you acquire or create will be in a readable format, written in a programming language such as C/C++ (e.g., Arduino) or any other language compatible with your system. Once you have the code ready, you can use an integrated development environment (IDE) or a compatible compiler to compile the code into machine-executable code. This executable code can then be uploaded or programmed onto the microcontroller or system responsible for controlling the vibrator sensor and the button input.

Keep in mind that the specific implementation details and code will depend on the vibrator sensor, button input, and the specific microcontroller or platform you are using. Thus, it is crucial to develop or find appropriate code that suits your system's requirements and adheres to its specifications.

The procedural steps can be observed in Fig 2 that highlights the states of vibrator sensor proceeded with the states of push button respectively. When the simulation begins the vibrator sensor activates the system. The status of the push button is taken into consideration onlyafter the vibrator sensor is made 1. If the push button is released it sends a message to the stored number stating that the person is in trouble along with the present location using the satellite connection read by the GPS module. When the person presses the button, the message stops and notify that the person is alright.

- When the device is turned on using power source, the vibrator sensor keeps the device activated in order to be ready to face the emergency.
- The relay model keeps running to indicate that the device is active.
- Once the vibrator sensor is turned on the device will now be ready to send the message to the stored number
- When the push button status is release or open it starts sending the coordinates of the person reading the current location using satellite signal.
- When the push button is turned on or closed the message stops and notify that the device carrier is now alright.

V. RESULTS AND DISCUSSION

The mission of the project was successfully completed, and the objectives of the project were reached. The result was to display the message sent by the GSM to the stored number when the button is pressed by tracking the current location of the victim and to send another message that the person in danger is safe when the button is released, the same is hence achieved by setting up the suitable environment in the proteus platform with the curate circuit to achieve desirable output.
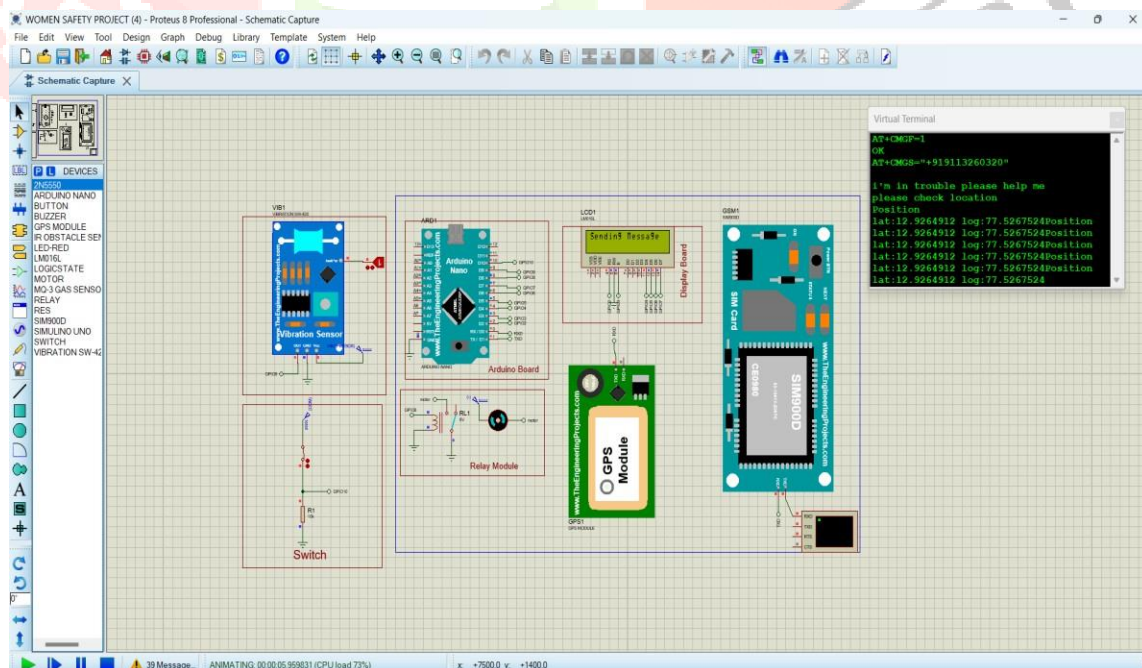

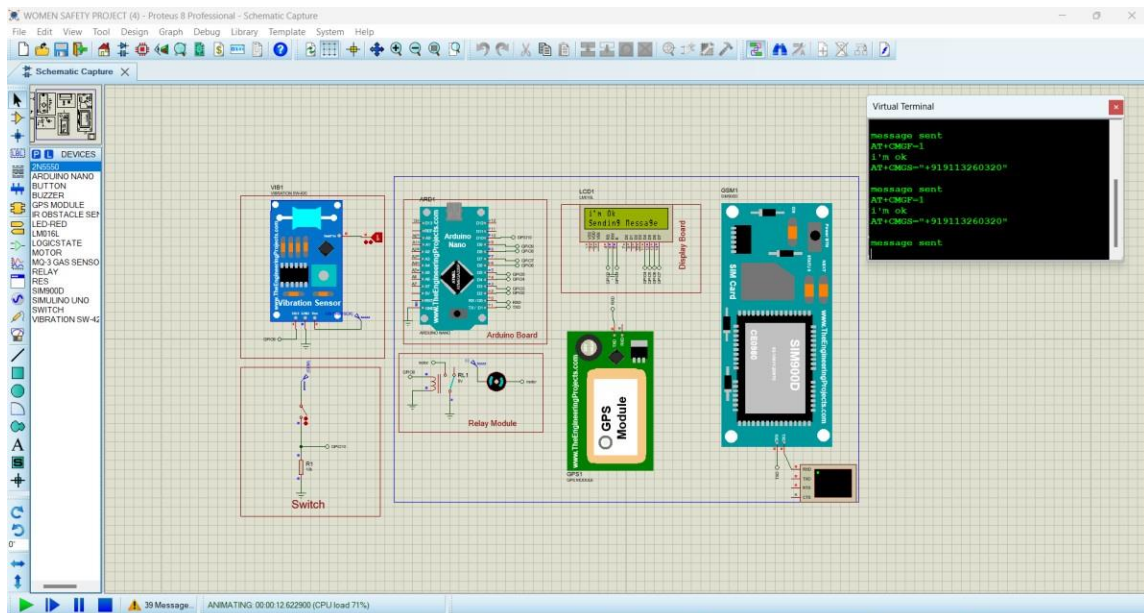**Fig 3. Alert message with coordinates sent to emergency number.**

Fig 4. Safe message is sent to the same emergency number.

VI. CONCLUSION

The proposed design seeks to tackle significant hurdles that women have faced in recent times and offer feasible remedies. These issues with the use of advanced equipment and innovative ideas. This solution can alleviate the concerns of safety and security thatplague women across the country. The solution for women's safety in India can be found in a cost-effective device that addresses women's challenges. This device enables sharing one's location with trusted contacts and creating a distress message to prevent further harm. This device can be made more compact and wearable by utilizing an Arduino Uno, allowing it to be seamlessly integrated into fabrics for added convenience. Additionally, the device is designed to operate on low-powered rechargeable batteries, enhancing portability. In this study, the combination of GSM and Arduino technology has been employed to develop a women's safety system that aligns with the principles of smart cities. The system incorporates Arduino UNO, GSM, GPS, and sensors. In critical situations, the GSM and GPS components enable the victim's message and location to be transmitted to the authorized network, facilitating their quick and accurate identification. However, it is important to note that the system may face limitations in areas with limited connectivity. To overcome this challenge, future work should focus on integrating GPS location and transmitting danger messages to the surrounding public based on their respective locations.

In today's society, the safety of women has become a pressing concern due to the escalating incidents of sexual harassment and rape. Disturbing headlines in various media outlets and the continuous rise in these crimes highlight the urgent need for effective solutions. Innovative technologies like Arduino and GSM models are being harnessed to address this issue and improve women's safety.

With these tools, women can feel more secure when traveling to unfamiliar areas. Additionally, these models can be used to develop safety apps that could further enhance women's protection. While our current model is effective for tracking, there are other devices available that can serve as tracking tools. One possible alternative is a camera, which can capture images and record events. Other options include hidden cameras, such as those embeddedin clothing items or accessories, as well as loud alarms or buzzers to alert the victim.

One solution to prevent crimes against women is developing apps designed specifically for this purpose. When activated with an emergency button, these apps can immediately notify a pre-selected contact list, including parents, friends, and the closest police station, about the victim's location. Similarly, voice detectors can also detect distress in the victim's voice and alert authorities accordingly. These technologies can be further improved in the future as well.

VII. ACKNOWLEDGMENT

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