

Design and Practical Application of a Cost Effective Intelligent Female Surveillance System Using GPS, GSM, and Arduino Technology

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Abstract. This paper suggests a cost effective, portable and intelligent surveillance system for women that they can utilize in risky or emergency situations. In this design, an Arduino Nano microcontroller, a GPS module, and a GSM module are the main parts used. Whenever an emergency arises, the user can instantly send an emergency message to a preset phone number along with their current location. The emergency activation button is in a handy place on the gadget, which is tiny enough to carry in a pocket or purse. This device will improve women's protection and security, particularly in places with high crime rates or poor public safety.

Keywords: Women Safety, Arduino Nano, GSM, GPS, Arduino Nano microcontroller.

1 Introduction

Women's safety has long been a top priority for them on a global scale. Women experience threats both inside and outside of their homes. There are some areas of India that are so unsafe that people are afraid to even leave their homes after dark. Nowadays, there are more women working in the business and Technology industries, which are growing. Women are frequently required to work nighttime shifts as part of their occupations, but there is no reliable public transport available at that time and that is open at that time, and there are not many cabs, which are more difficult to obtain and frequently more expensive in far off regions. Because of this, it is challenging for women to walk home. An effective fast response strategy that aids women in crisis is presented in an emerging research analysis [1, 2, 3]. The purpose of the project is to focus on developing a security system specifically for women to ensure that they do not feel defenceless when confronted with these kinds of social concerns. The suggested device operates more as a safety mechanism in an emergency. An intelligent security system built on microcontrollers is the answer to the problem of women's safety. An Arduino Nano microcontroller, a GPS module, and a GSM module are the major components used in the design of women's safety system. The microcontroller known as the Arduino Nano serves as the system's brain and manages the GPS and GSM components. The Arduino programming language, which is based on C and C++, is used to programme the microcontroller. When an emergency occurs, the GSM module is utilized to send alert

messages to previously defined contacts while the GPS module tracks the user's location [4, 5]. The alert messages can be delivered via phone call or SMS.

2 Proposed technique

2.1 Existing techniques

The majority of modern personal security systems include defensive tools like stun guns, panic buttons, and individualized security products. These gadgets are typically small, portable, and easy to use, which makes them popular choices among people today who want to increase their personal protection. These gadgets have various restrictions, even if they can be useful in some circumstances. They need manual activation, for instance, which is not always practical or efficient in emergency situations. Also, they do not offer real time location tracking or automatic alerting to predefined contacts, which are crucial in the event of an assault or emergency.

2.2 Proposed technique

The suggested system, which makes use of the Arduino Nano, GPS, and GSM technologies, is superior to the current basic safety devices in a variety of respects. In the beginning, it is designed to provide real time location tracking and prompt communication to pre-specified contacts in urgent situations. Additionally, the device can immediately send an alert message to predefined contacts, such as family members, friends, or emergency services, in case of an emergency. This enables the user's location to be tracked in real time using GPS technology. The proposed system needs very less manual activation due to its increased user friendliness. After pressing a button to turn on the system, the user can start tracking their whereabouts and receive alert messages if an emergency occurs.

Lastly, the suggested system is small and lightweight, making it simple to carry in a pocket or purse. This implies that the user can always carry it with them and that it won't be a burden. Overall, the suggested system is a vast improvement over the current personal security systems since it offers real time location tracking, automatic notification, and ease of use in a small, portable package.

3 Modelling and Analysis

When the gadget receives electricity and the individual who uses it flips the push button, the GPS starts tracking their location. The controller then sends the user's location, together with the latitude and longitude, to the emergency contacts through SMS or GSM calls.

3.1 Structure of the suggested work

The startup of the system, which involves setting up the Arduino Nano [6] and the GPS and GSM modules [7], is the first step in the flowchart. The system starts the main loop after initialization is finished and begins reading data from the GPS module continuously. Once the device is turned on and in contact with satellites, the GPS system starts tracking the user's

location [8, 9, 10]. The microcontroller detects the command when the button is pressed and responds appropriately to contact the predefined contacts through GSM.

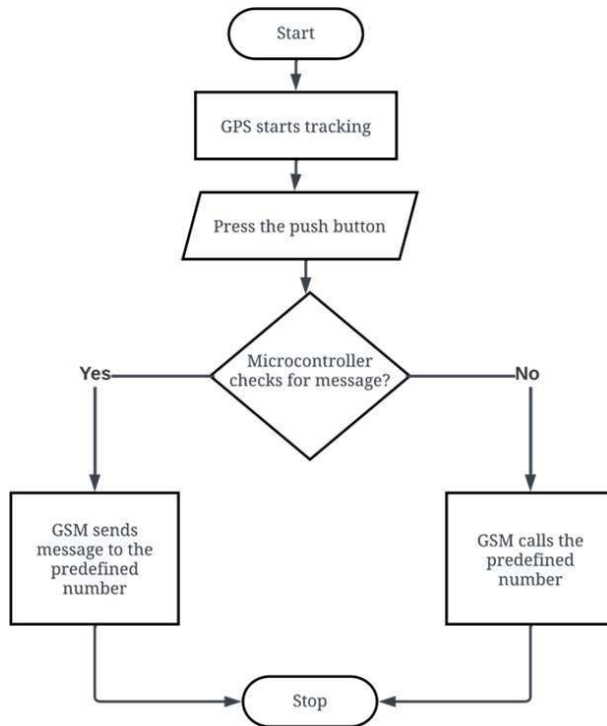


Fig. 1. The suggested work's organization.

4 Hardware Implementation

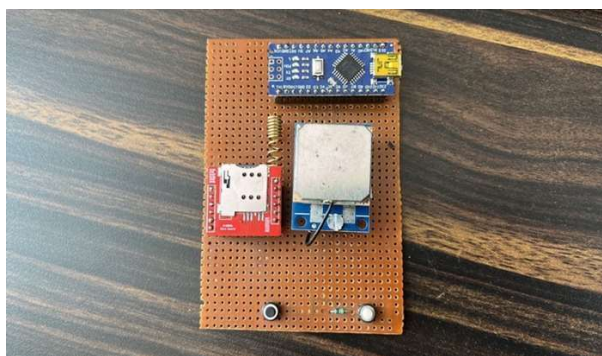


Fig. 2. Major Components connected on the PCB.

The suggested technique utilizes an Arduino Nano processor to develop a system for female safety and defence. With the help of the Arduino platform, it is possible to create computing devices that are more competent than typical desktop machines at detecting and manipulating the real world [11]. It consists of a simple microcomputer chip-based hardware technology system which is free to use, in addition to an environment for programming for developing

programmes on the chip. This same task finally moved on to soldering essential parts, including the Arduino Nano board, GSM module, and GPS module, on the PCB, as shown in Fig. 2.

In addition, a battery charger (TP4056) to charge the rechargeable 3.7 V LiPo battery and push buttons for call and SMS purposes were added to complete the connections. Following that, the two terminals of a condenser were soldered. Connect the micro phone terminal to the GPS module's MIC+ and MIC- pins next (sim800L). When certain sound levels are reached, an alarm or alert system is triggered.

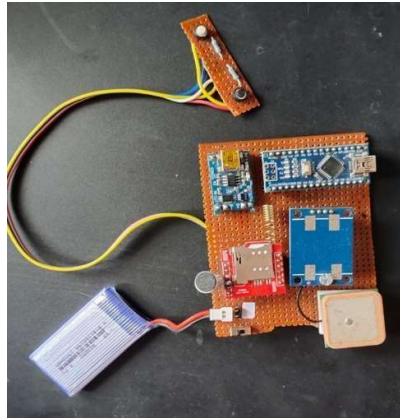


Fig. 3. Final hardware circuit.

The circuit will be ready to be utilized after all the necessary interconnections are made and the battery supply is attached. If the sensors detect a potential threat, the alarm will sound, and the light will illuminate. If the user presses the panic button, the circuit will carry out all the actions that have been programmed into it, such as sending an SMS alert and calling someone.

5 Results and Discussions

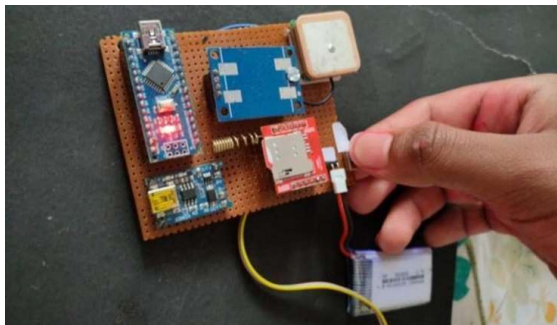


Fig. 4. Switch ON the power supply.

To start the system, switch the power supply to "ON." The Arduino Nano receives a command to start the system's control software when the push button is pressed. When a user clicks the emergency push button, the system is set up to send a text message to a

predetermined phone number via the GSM unit. The GSM module may blink in this situation to show that it is transmitting a message.

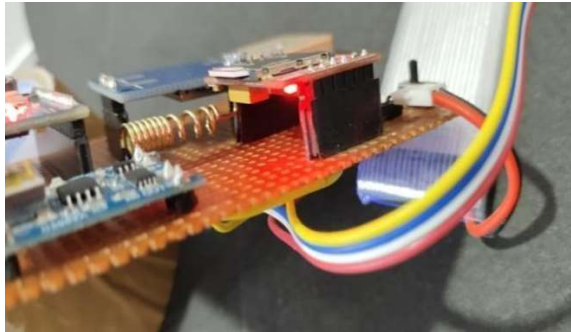


Fig. 5. GSM signal recovered.

The GPS module will blink to indicate when a GPS signal is received or when position data is provided to the Arduino Nano. The tracking device must initially receive a GPS signal from satellites after being powered up to determine the user's location. The GPS flash during this period can mean that the module is looking for a signal. After acquiring a signal, the GPS blink may alter to show that the module has locked onto the signal and is sending location information to the Arduino Nano.

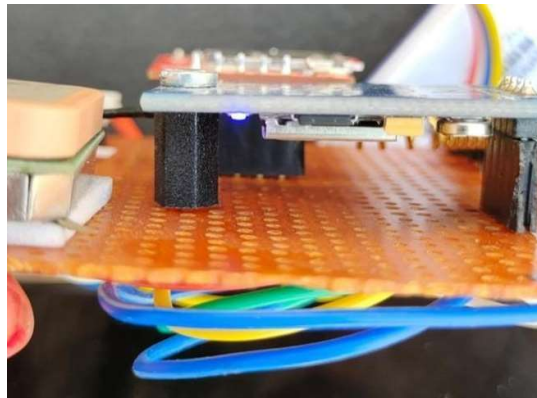


Fig. 6. GPS signal retrieved.

By tapping it, the individual may send an instant message with their position information to a predetermined phone number or emergency service. The panic button, which is wired to an Arduino Nano and set up to convey a particular signal or text when pressed, is attached to the Arduino Nano.

5.1 When Pressing an Emergency SMS Button

The female's protection circuit is constructed with a GSM (800L) subsystem, GPS Neo 6M module, and Arduino Nano. The subsequent actions are taken to send a message.

When a woman is being harassed, she only needs to click the button, and the location will be transmitted as a text message notification to a selected phone number, including longitude and latitude information.

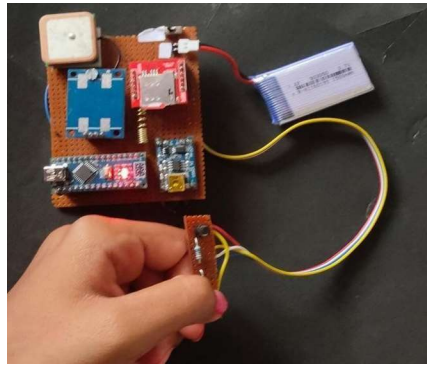


Fig. 7. Triggering a Push button.

A digital input pin on the Arduino Nano is connected to the emergency button. The mini version of the Arduino recognizes when a button gets pushed and generates an interrupt when the input state alters. The device's position is determined by the interrupt routine by reading the GPS coordinates from the GPS Neo 6M module. After that, a short text message is sent via the GSM (800L) unit to a particular telephone number or set of numbers that have been predefined and saved in the programme storage. In addition to a predefined message stating that an emergency has occurred, the SMS message also includes the device's GPS locations. Finally, women should feel safe as a result of this endeavour.



Fig. 8. Location in longitude and latitude.

5.2 When Pressing an Emergency Call Button

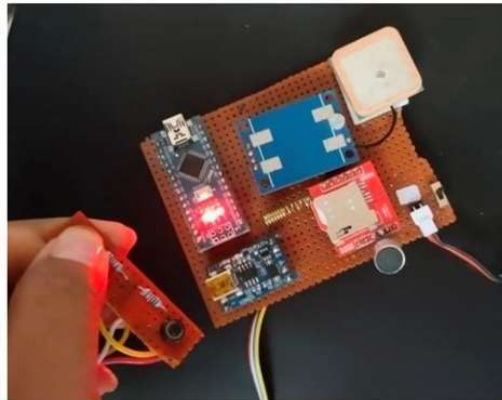


Fig. 9. Pressing an emergency call button.

A women's security circuit is developed with a GSM (800L) module, GPS Neo 6M module, and Arduino Nano performs the subsequent tasks when an emergency call button is pressed.

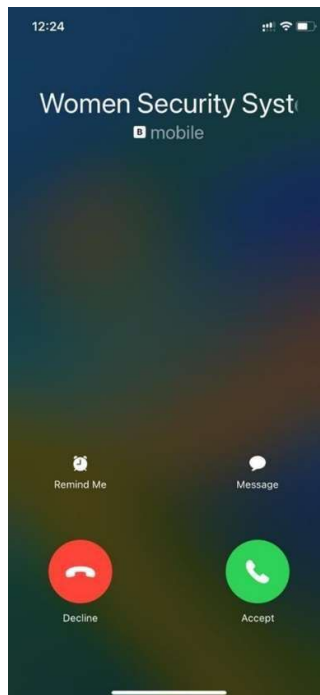


Fig. 10. Calling an emergency contact.

One of the digital input pins on the Arduino Nano is connected to the emergency call button. The tiny version of the Arduino recognizes the change in input state caused by pressing the emergency call button and initiates an interrupt. The device's position is determined by the interrupt routine by reading the GPS coordinates from the GPS Neo 6M module. The next step is to use the GSM (800L) module to place a call to a preset number or a collection of

numbers that are saved in the programme memory. The GSM module starts the call by sending the AT command to the cellular network.

When the call is answered, the gadget tells the recipient where they are and what the emergency is, as well as providing location data. Once that has happened, the recipient can act accordingly.

When the emergency button is touched, the women's security circuit is able to call specified numbers and deliver position information and an emergency message because of the integration of the Arduino Nano, GPS Neo 6M module, and GSM (800L) module.

6 Conclusion

The purpose of this project is to design and fabricate a small, straightforward, intelligent security gadget that provides women with the benefit of personal security in perilous circumstances. It is an affordable system that can keep track of friends' and family members' phone numbers in a certain location and instantly send out an emergency warning. As a result, women experience greater safety.

7 Future Scope

Our main objective is to ensure the protection of women, and the suggested model will contribute to achieving that objective by eventually delivering this device to distant locations where women may use it economically and feel confident leaving their homes. A heart rate sensor can be added to this system to make it more sophisticated. The advanced system's camera can also be utilized to capture images of the attacker and send them to the nearest police station or emergency number.

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