

A Study on Arduino Uno Based Women Safety

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Abstract: In a time when concerns about women's safety are ever growing, technological improvements can be extremely important in boosting individual safety. The creation of a novel women's safety system based on the popular Arduino UNO microcontroller is suggested by this study. During emergencies, the system seeks to notify others and offer prompt aid, enabling women to defend themselves in perilous circumstances. A GPS module, accelerometer, and push-button switch are just a few of the sensors that are integrated into the suggested solution to track the user's location, identify unusual motions, and send out real-time alerts. The system's primary function is its capacity to notify pre-designated emergency contacts by SMS or mobile applications of distress when an anomaly, like abrupt physical impacts or aggressive movement, is identified. Furthermore, the GPS module gives the user's present location, enabling prompt action by family members or emergency services. The system's lightweight, portable, and user-friendly design ensures that it provides a dependable security solution without interfering with daily activities.

Keywords: GPS module, location, women's safety, Arduino Uno, Grad-CAM, personal security, and SMS alert tracking and alerts in real time.

I. INTRODUCTION

According to allegations of assault, harassment, and other dangerous circumstances, women's safety remains a major concern on a global scale. Creating news on a regular basis. In the modern world, technology may significantly improve personal safety, particularly for women in public areas. In an emergency, conventional safety measures like carrying pepper spray or depending on others for assistance cannot always be practical or trust worthy. By creating a women's safety system with an Arduino UNO microcontroller, this study seeks to solve this issue. The system is intended to be a straightforward but useful instrument that can provide women a sense of security. The system can track a user's movements by combining various sensors, including an accelerometer and GPS module. Position, identify abrupt motions or falls, and instantly send out emergency notifications. These notifications can be sent to pre-specified contacts by SMS, guaranteeing prompt assistance. Because of its lightweight, portable, and user-friendly design, the system shouldn't interfere with day-to-day tasks. It's made to be accessible and reasonably priced, making it a workable way to improve women's safety without depending on pricey or intricate equipment. This essay will go into the system's conception, creation, and deployment in addition to how it might enhance individual security. Using readily accessible parts like the Arduino Uno, we intend to offer a straightforward, affordable, and dependable way to make women feel safer in their daily lives.

II. LITERATURE REVIEW

[1] S.P.Rao (2020): Design and Execution of an Arduino-Based Women's Safety System International Journal of Electrical, electronic, and instrumentation engineering research at the highest level.

Overview: This article introduces an Arduino UNO-based women's safety system that combines GPS, GSM, and an emergency button for location tracking and real-time notifications. The authors suggest a way to guarantee that help reaches the person in a timely way by sending SMS notifications to pre-specified contacts in the event of an emergency.

Research Focus:

- The Arduino UNO's interface with GPS and GSM modules is the main area of research.
- Emergency communication and real-time location tracking.
- Providing a rapid response system to empower women.

[2] Gupta,R.K.(2018) An Arduino-Powered Smart Women's Safety System International Journal of Engineering Research & Applications

Overview: Gupta et al. create a system that tracks a woman's surroundings and sends distress signals when she is in danger using an Arduino-based platform.

The system consists of a wearable gadget with a vibration sensor to identify unusual motions and a button that, when hit, sounds an alarm. Additionally, the system has the ability to record audio and video in order to gather proof for later use.

Research Focus:

- Arduino based wearable safety gadgets.
- Recording audio and video in order to gather proof.
- Sensor integration to identify questionable activity.

[3] Journal of Electrical and Electronics, N.M. V. R. Kumar (2019), *Arduino-Based Women's Safety and Security System research in engineering*.

Overview: Using Arduino, this study suggests a complete safety system with a panic button, GPS, and SMS capabilities. The system also incorporate a sound detection module that, in the event that unusual noises, such as screaming or shouting, are detected, sounds a warning. The incorporation of an accelerometer to detect falls or abrupt movements, which can further trigger the emergency response, is also covered in the article.

Research Focus:

- Sound and movement detection for automatic activation of safety measure.
- Integration of emergency communication feature.
- Low cost, low power solutions for women's safety.

[4] D.S.Soni and S.Patel (2021) *Arduino- Based Internet of Things-based Women's Safety System International Journal of computer science as well as information security*.

Overview: This study investigates the development of an intelligent women's safety system using Internet of Things- based technologies. A GPS tracker, an accelerometer, and a sound sensor are among the sensors that are connected to the system via an Arduino UNO board. The system's ability to send out an alarm to authorities or designated contacts and deliver real-time updates via the Internet of Things (IoT) for improved monitoring and support is covered in the study.

Research Focus:

- IoT integration for real-time updates.
- Use of multiple sensors (GPS, accelerometer, sound) to ensure safety.
- Monitoring and alerting through web and mobile platforms.

[5] A.B. Patel (2017) *Women Security System Using Arduino and Android Application International Journal of Advanced Applications of Computer Science*.

Overview: An Arduino-based women's safety system that is connected to an Android smart phone app is covered in this paper. A lady can use the system to notify authorities and contacts in her immediate vicinity of her GPS location in order to transmit a distress signal. To provide an extra degree of security, the device also employs an Android app to give users' loved ones real-time alerts and position monitoring.

Research Focus:

- Integration with mobile application for real-time tracking.
- Combining hardware with mobile technology for enhanced user experience.
- Proactive safety alerts to prevent emergencies.

[6] Women Safety System Using GPS, GSM, and Arduino Journal of Engineering and Technology, K. S. Patel, S. B. Deshmukh (2020) *technology*.

Overview: This paper describes an Arduino-based system that locates a woman in distress in real time using a GPS module. The system uses GSM to send SMS notifications to emergency contacts in addition to location data. The authors investigate a number of ways to activate the system, including hitting a panic button or having it activate automatically in response to external stimuli.

Research Focus:

- Integration of GPS and GSM for location-based alerts.
- Activation via physical button or automatic sensing.
- Practical design considerations for cost-effective implementation.

[7] S.N.R.Nair(2022) *Automatic Women's Safety System with Real-Time Alerts Using Arduino International Journal of Computer Science, Mobile computing and science*.

Overview: An Arduino-based automated safety system with a built-in communication system and a fall detection sensor. If the system notices a fall or other unusual activity, it automatically notifies predetermined contacts by SMS or a mobile app. The authors also investigate how machine learning methods might be used to increase the precision of threat identification and reaction.

Research Focus:

- Fall detection and threat recognition using sensors.
- Integration with machine learning algorithms for real-time analysis.
- Automatic alert systems for emergency response.
- Low cost, low power solutions for women's safety.

[8] R.S.Deshmukh (2023) *Arduino and Cloud Technology in a Smart Women's Safety System Journal of Sensors and actuators*. **Overview:** The integration of cloud computing with safety systems based on Arduino is investigated in this study. Authorized contacts or emergency services can access the cloud server where the suggested system transmits distress signals and GPS location. By storing data for later analysis and tracking, the cloud platform adds an extra degree of security.

Research Focus:

- Integration of cloud technology for enhanced safety.
- Real-time tracking and alerts through cloud services.
- Long-term storage and analysis of data for security monitoring.

[9] M.J.S.Gajbhiye (2019) An Arduino- based women's safety system featuring a GPS and GSM module. The International Journal of Computing and Engineering Science.

Overview: This study investigates an Arduino-based system that sends emergency contacts real-time distress messages by utilizing GPS and GSM modules. The technology helps rescue crews or family members find and help the individual in trouble by using SMS alerts with geographic location and a panic button. In an emergency, the emphasis is on offering a rapid and effective channel of communication.

Research Focus:

- Arduino – based GPS and GSM integration.
- Panic button mechanism.
- Emergency communication and real-time location tracking.

[10] N.V.V.Reddy (2020) Arduino and IoT- Based Smart Women Safety System International Journal of Electrical and Telecommunications and Electronics Engineering.

Overview: The creation of an Arduino- based women's safety system enabled by the Internet of Things (IoT) is covered in this paper. A temperature sensor, a GPS module, and a vibration sensor are among the several sensors that are part of the system. It can identify anomalies like hostile behavior or changes in the surroundings (such an increase in temperature), which cause an alarm to be sent via IoT-enabled platforms.

Research Focus:

- IoT-based safety system design.
- Integration of vibration and temperature sensors.
- Real-time alerting through IoT cloud platforms.

[11] P.S.Thakur (2021) International Journal of Innovative Research in Computer Science: Arduino-based Women Safety System with Audio Surveillance & Technology.

Overview: Thakur et al. suggest a system that incorporates an audio surveillance system with additional safety features like a GPS tracker and a GSM module using an Arduino board. The system continuously scans the environment for unusual noises (such as yelling or calls for assistance), and it notifies pre-specified contacts when a certain threshold is reached.

Research Focus:

- Audio surveillance for detecting distress signals.
- Integration of sound detection and alerting mechanisms.
- Application of GSM and GPS for real-time communication.

[12] Women's Safety Using Arduino and Cloud Technology, S. S. Mehta, R. K. Singh, and A. P. Yadav (2020) Journal of Technologies related to computing and communication.

Overview: This study combines cloud computing with Arduino to protect women. The system designed by the authors uses sensors (such as motion, temperature, and GPS sensors) that are connected to an Arduino to send out alerts when anomalous situations are found. Authorized people can track the woman's position and state in real time by using the data that the system provides to a cloud- based platform.

Research Focus:

- Cloud-based monitoring of women's safety.
- Use of multiple sensors to track environmental and motion changes.
- Real-time updates on a web-based interface.

[13] B.R.Patil and S.S.Joshi(2021) Arduino-Based Wireless Communication International Women's Security System Engineering & Technology Journal.

Overview: This study describes an Arduino-based women's safety system that transmits distress signals via wireless communication technologies like ZigBee. The system has sensors to identify physical hazards (such as abrupt movement, sound, or vibration) and wirelessly communicates those indications to the closest security or emergency team.

Research Focus:

- Use of ZigBee wireless technology for distress signal transmission.
- Threat detection via motion, sound, And vibration sensors
- Cost-effective and efficient wireless communication in safety systems.

[14] Rathore, R.B.A.(2022) Wearable Safety System for Women Using Arduino International Journal of Research in Engineering and computer science.

Overview: The design of an Arduino-based wearable women's safety system is covered in this study. The wearable gadget has accelerometers to detect falls or abrupt jerks, as well as a button for manual distress notification. It also provides the emergency contacts with the woman's precise position and sends alerts via GPS and GSM.

Research Focus:

- Design of a wearable safety device.
- Integration of accelerometer sensors for fall detection.

[15] D.C. Anusha et al. (2022): Design and Implementation of Women Safety Smart Gadget Using IoT

Overview: This article describes a smart device that uses the Internet of Things to improve women's safety. The system has a panic button, GSM for SMS alerts, and GPS for tracking location. It has the ability to identify emergency situations and instantly notify law enforcement and family members of any changes.

Research Focus:

- IoT integration with Arduino-based safety device.
- Real-time emergency alert transmission via GSM.
- GPS tracking for live location updates.

Year	Author	Methodology	Technique / Module Used
2023	R.S.Deshmukh et al.	Cloud-based women safety System with Arduino	Cloud computing, GPS, GSM, Real-time updates
2022	S.N.R.Nair et al.	Fall detection and threat detection with Arduino	Accelerometer, GPS, GSM, machine learning for threat detection
2022	R.B.A.Rathor et al.	Wearable safety system with GPS and Accelerometer	GPS, accelerometer, panic button, GSM
2021	D.S. soniet al.	IoT-based women safety system with Arduino	GPS, GSM, IoT plat from, accelerometer, sound sensor
2021	P.S.Thakuretal.	Audio Surveillance for women safety with Arduino	Sound detection, GPS,GSM, Arduino
2021	B.R.patil and S.S.joshi et al.	Wireless communication with Arduino	Arduino, motion sensor, GSM
2020	S.P. Raoet al.	Arduino-based women safety system with GPS and GSM	GPS, GSM, SMS alert, real- time location tracking
2020	K.S.Patel,S.B. Deshmukh et al.	Arduino-based system with panic button and location tracking	GPS, GSM, accelerometer, motion sensor, panic button
2020	N.V.V.Reddyet al.	IoT-based women safety system	lot, vibration sensor, temperature sensor, GPS, GSM
2020	S.S.Mehta,R.K.Singh A.P.Yadav et al.	Cloud-based monitoring with Arduino	Cloud, GPS,temperature sensor, motion sensor
2019	N.M.V.R.Kumar et al.	Arduino-based system for panic button and fall detection	GPS, GSM, accelerometer, vibration sensor, SMS
2019	M.J.S.Gajbhiye et al.	Safety system with GPS, GSM, panic button	GPS, GSM, panic button, Arduino
2018	R.K.Gupta et al.	Wearable device with panic button	Arduino, GSM, GPS, vibration sensor
2017	A.B.Pateletal.	Mobile app based system with arduino	Arduino, androidapp, GPS, GSM, panic button

III. PROBLEM STATEMENT AND SOLUTION:

Problem:

The rising number of incidences involving harassment, assault, and other forms of violence in today's world has raised concerns about women's safety. While there are a number of mobile applications and safety precautions, they frequently depend on human input or require dependable internet connections, which could not be available in an emergency. Furthermore, a greater portion of society cannot afford many of these solutions due to their high costs and technical complexity, especially in rural and economically underdeveloped areas. A straightforward, reasonably priced, and efficient safety system that can function dependably even in places with poor connectivity and offer prompt aid without relying solely on human engagement is therefore desperately needed.

Solutions: In order to solve the issue of women's safety, we suggest creating an intelligent safety system based on an Arduino UNO that can provide emergency contacts with location data and real-time notifications in dire circumstances. The system incorporates sensors such as accelerometers and sound detectors to detect anomalous activity such abrupt falls, violent movements, or loud distress sounds, as well as a GPS module to continuously track the user's location and a GSM module to send distress SMS messages. The woman can manually press a panic button in an emergency, which will cause the Arduino to record her current GPS coordinates and instantly send an SOS message to pre- specified contacts via the GSM network with the location link. As an alternative, if the system automatically picks upon unusual motions or noises.

IV. METHODOLOGY

1. Motive of Study:

Women's safety in India is currently a top concern. The rates of crime against women in the nation have only increased further. Women are cautious while leaving their houses, particularly after dark. Unfortunately, this is the depressing truth of our nation, which is constantly afraid. There is hardly a day that passes in India that you do not hear about a crime against women.

2. SOS Message:

This emergency notification includes our present position as determined by Global Positioning System (UBLOX) and transmitted to the GSM module, which transmits our location and our pre-stored contacts' default emergency message.

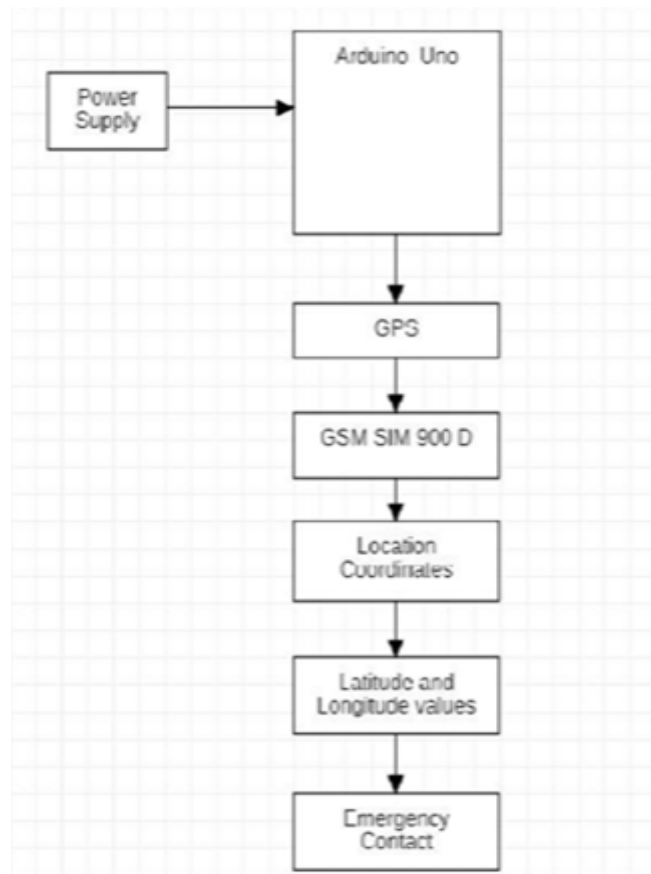


Fig1: Block Diagram

3. Define the System and Requirements

Determining what the system should perform is the first stage. The objective is to develop a safety tool that:

- In the event of an emergency, notifies authorities or emergency contacts.
- Uses GPS to track the wearer's whereabouts.
- It is wearable, compact, and simple to operate.

4. Select and Connect Components

In this stage, we select and connect the appropriate system components:

- **Arduino Uno:** This is the system's brain, in charge of all operations.
- **GPS Module:** To monitor the wearer's whereabouts.
- **Accelerometer:** Identifies abrupt motions or impacts that could indicate danger.
- **Panic Button:** To manually issue an alert, the user hits this.
- **GSM Module:** Calls or sends SMS messages to emergency contacts.
- **Buzzer:** Sounds when the alarm is activated.
- **Power Source:** The system is powered by a battery.

5. Write the Code

Once everything is connected, the Arduino must be programmed to create the system. work.

- **GPS Code:** To determine the location, the Arduino reads information from the GPS module.
- **Accelerometer Code:** The Arduino looks for abrupt motions or drops using the accelerometer.
- **Panic Button Code:** The Arduino provides an alert if the user touches the panic button.
- **SMS Code:** In the event of an emergency, the GSM module notifies emergency contacts by SMS of the position.
- **Sound Alert:** To verify that the system has been turned on, a buzzer will sound.

6. Build the Prototype

We now construct the device's physical form:

- **Put the Components Together:** Put all of the attached pieces into a tiny, wearable casing (such as a keychain, wristband, or necklace).
- **Evaluate the system:** Verify that everything functions as a unit. Verify that the GPS follows the location, the panic button transmits the message, and the accelerometer accurately detects movements.

7. Test and Improve

Put the system to the test in actual scenarios:

- **Test Functionality:** Move the smart phone around, press the panic button, and see if the location tracking and SMS alert function.

- Gather User Input: Allow individuals to test and wear the item to determine its use and comfort. Make changes in response to comments.

These procedures can be used to develop and improve the Arduino Uno-based women's safety system.

8. Hardware and Software Hardware:

The physical parts that make up the hardware cooperate to guarantee that the gadget operates as planned. The primary hardware components and their functions are as follows, based on the methodology:

1. Arduino Uno:

- Its functions include sending commands, processing data, and coordinating everything else. It serves as the system's brain, carrying out the commands that the software gives it.

2. GPS Module (UBLOX, for example):

- Function: The GPS module continuously collects signals from satellites and transmits location information to the Arduino, including latitude and longitude. Sending this data is a component of the emergency notification as required.

3. Accelerometer:

- Function: It detects motions that might be signs of danger, such as falls or abrupt shocks.

4. Panic Button:

- Function: Its purpose is to allow users to press when they feel in danger. To activate the system, press the panic button.

5. The GSM Module:

- Function: The GSM module notifies the pre-stored emergency contacts via emergency SMS of the location as soon as the Arduino receives the signal from the panic button or senses a fall.

Software:

The programming that operates on the Arduino and enables the hardware components to cooperate is known as the software. Data processing, decision-making, and emergency contact communication will all be managed by the software. The software functions as follows for each component:

1. GPS Code:

- Function: The Arduino continuously retrieves latitude and longitude data from the GPS module. The software converts this data into an SMS and uses the GSM module to deliver it to emergency contacts in the event of an emergency.

2. Accelerometer Code:

- Function: The Arduino receives movement data from the accelerometer. The software looks for abrupt variations in the accelerometer's data that might point to a fall or other upsetting motion.

3. Panic Button Code:

- Function: The program continuously keeps an eye on the condition of the panic button. The code tells the Arduino to send contacts an emergency SMS with the user's GPS position if the button is hit. Additionally, it sounds the buzzer for confirmation.

V. FUTURE SOLUTION

The women's safety system based on an Arduino UNO offers a solid basis for boosting personal security, there are a number of opportunities for future development and growth. The integration of Internet of Things (IoT) technology to facilitate real-time monitoring via cloud platforms is one significant area of development. This enables family members and authorities to continuously watch the user's whereabouts and status from a centralized dashboard. By using machine learning techniques, the system may be able to identify intricate patterns of danger from sensor data, improving its intelligence and hazard prediction accuracy. Furthermore, biometric sensors like skin temperature and heart rate monitors may be incorporated into the future system to identify physiological indicators of stressor anxiety. When abnormal readings are detected, notifications may be automatically triggered. Voice recognition technology that listens for particular terms (such "help" or "rescue me") and instantly triggers the emergency response without a button click could be another important improvement. Additionally, the device can be further reduced in size to blend in with belts, clothing, or smart jewelry, making it even more discrete and portable.

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