

Intruder Detection with GSM Alert (PIR Sensor + GSM Module)

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ABSTRACT: Security has become a major concern in residential, commercial, and industrial environments. This project presents an intruder detection system based on a Passive Infrared (PIR) sensor integrated with a GSM module to provide real-time alerts. The PIR sensor continuously monitors the protected area and detects human presence by sensing variations in infrared radiation emitted by moving objects. When an intruder is detected, the microcontroller processes the signal and triggers the GSM module to send an alert message (SMS) or call to a predefined mobile number. This enables immediate notification to the user, even when they are away from the premises. The system is simple, cost-effective, and reliable, making it suitable for home and office security applications. By combining motion detection with wireless communication, the proposed system enhances safety and ensures quick response to unauthorized access.

I. INTRODUCTION

With the increasing need for security in homes, offices, and restricted areas, automated intruder detection systems have become essential. An Intruder Detection System using a PIR sensor and GSM module provides a reliable and cost-effective solution for real-time monitoring and alerting. This system is designed to detect unauthorized human movement and immediately notify the user through mobile communication.

The Passive Infrared (PIR) sensor plays a key role in detecting motion by sensing changes in infrared radiation emitted by the human body. When an intruder enters the monitored area, the PIR sensor generates a signal indicating motion detection. This signal is processed by a microcontroller, which then activates the GSM module.

The GSM module enables wireless communication by sending an alert message (SMS) or making a call to a predefined mobile number. This ensures that the user is instantly informed of any intrusion, even when they are not physically present at the location. The system operates independently of internet connectivity, making it suitable for remote and rural areas.

II. LITERATURE SURVEY

1. Literature Survey: Intruder Detection Systems Real-Time Alerts: Research by Adwait et al. (2024) shows that traditional CCTV is often passive (recording only). Smart systems using microcontrollers provide active security by notifying owners instantly during a breach.
2. Sensor Reliability: Studies by Narender (2025) confirm that PIR sensors are superior to other motion sensors because they detect human body heat (infrared), allowing them to work effectively in total darkness and consume very little power.
3. Communication Choice: Abdullahi (2026) highlights that GSM technology (SIM800L) is more reliable than Wi-Fi for security. It ensures alerts are sent even if the home internet is cut or unavailable, using standard cellular networks.
4. System Integration: Recent projects by Ikpenyi (2022) demonstrate that combining an Arduino Nano with an LCD 16x2 creates a user-friendly interface for local monitoring while maintaining a small, cost-effective footprint.

III. METHODOLOGY

***System Methodology** The system combines motion sensing and cellular communication for real-time security.

A PIR sensor detects human movement and triggers the Arduino Nano.

The Nano initiates a GSM alert to provide instant remote notification.

***Hardware Methodology** Arduino Nano: Main controller for processing sensor signals and GSM logic.

PIR Sensor: Detects infrared heat signatures from moving humans.

GSM Module (SIM800L): Executes SMS alerts and calls to the user's phone.

16x2 LCD: Provides local status updates and alert messages.

Power Supply: Delivers regulated DC power to all system modules.

***Software Methodology** Developed in Embedded C using the Arduino IDE.

Monitors digital inputs and manages Serial Communication with the GSM module.

Uses AT Commands to interface with the cellular network.

Runs a continuous polling loop for immediate response to triggers.

***Working Methodology** Sense: PIR sensor detects motion and sends a signal to the Nano.

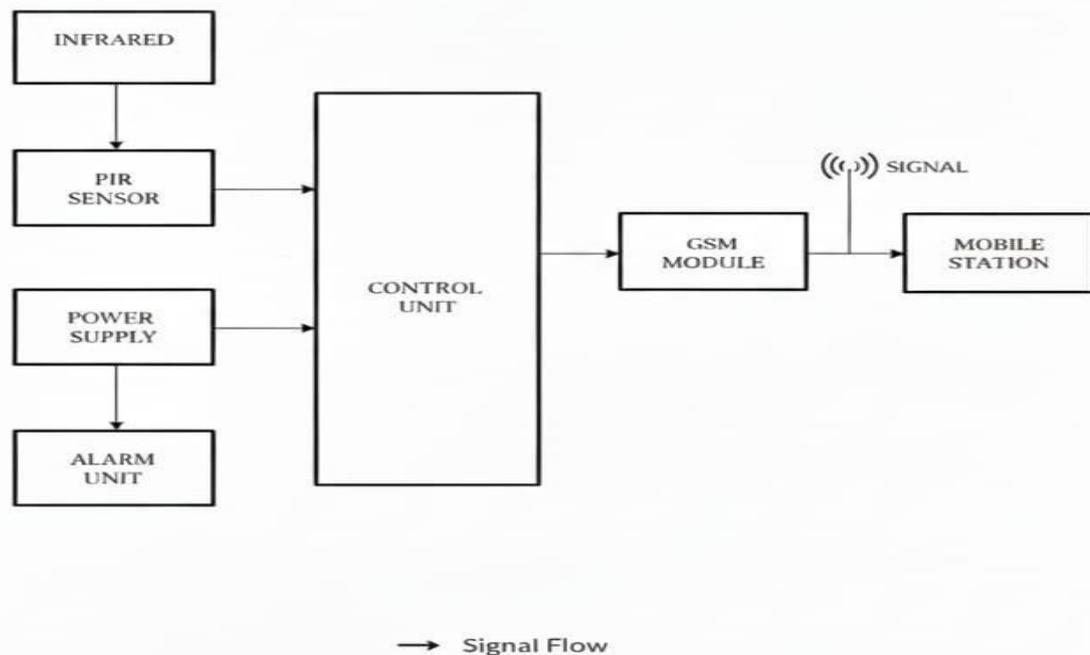
Process: Nano confirms the intrusion and updates the local LCD.

Alert: The GSM module sends an SMS/Call to the pre-programmed number.

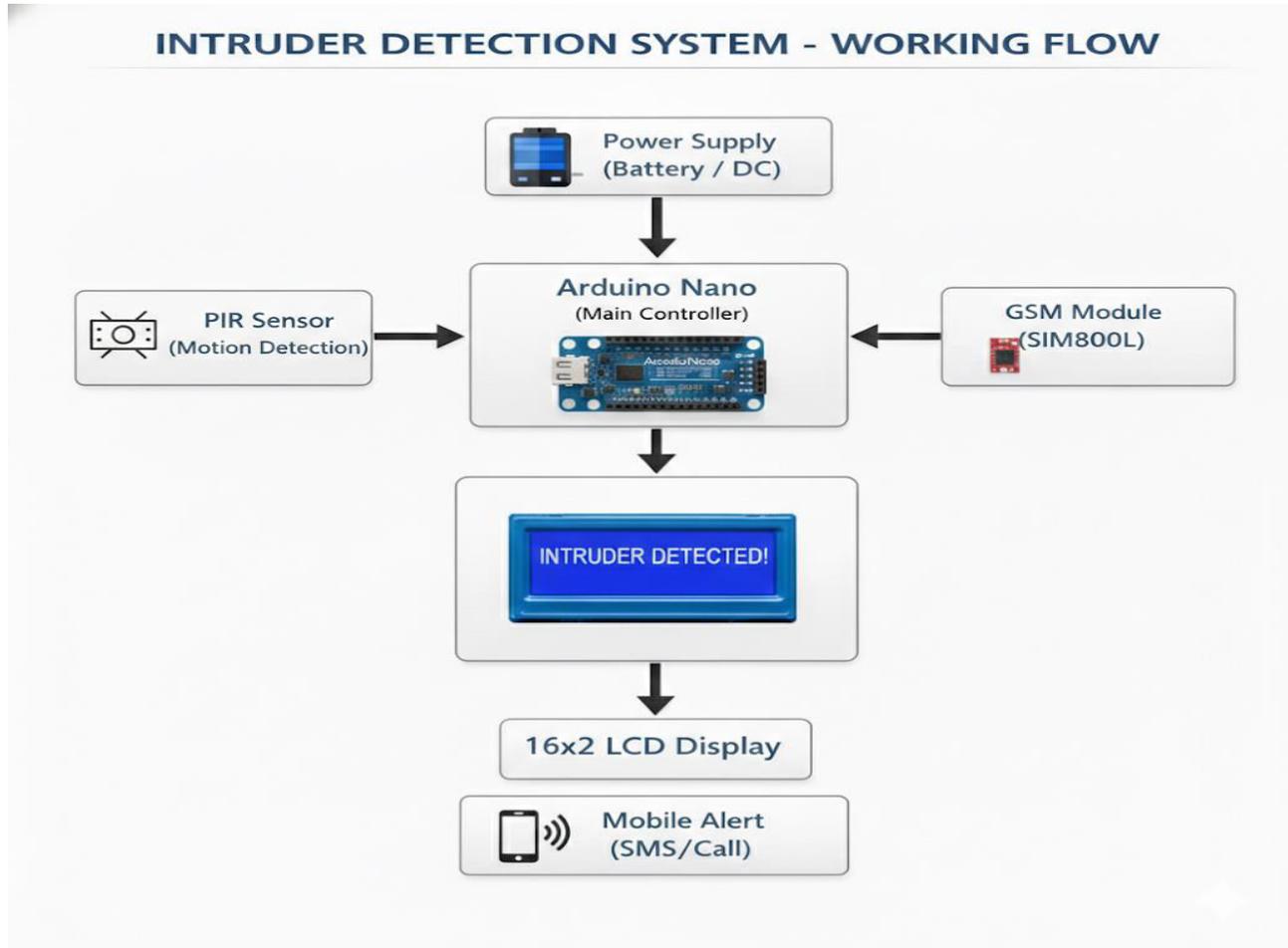
Response: The user receives the notification on their mobile device instantly.

Block Diagram:

Alarm and Communication System Block Diagram

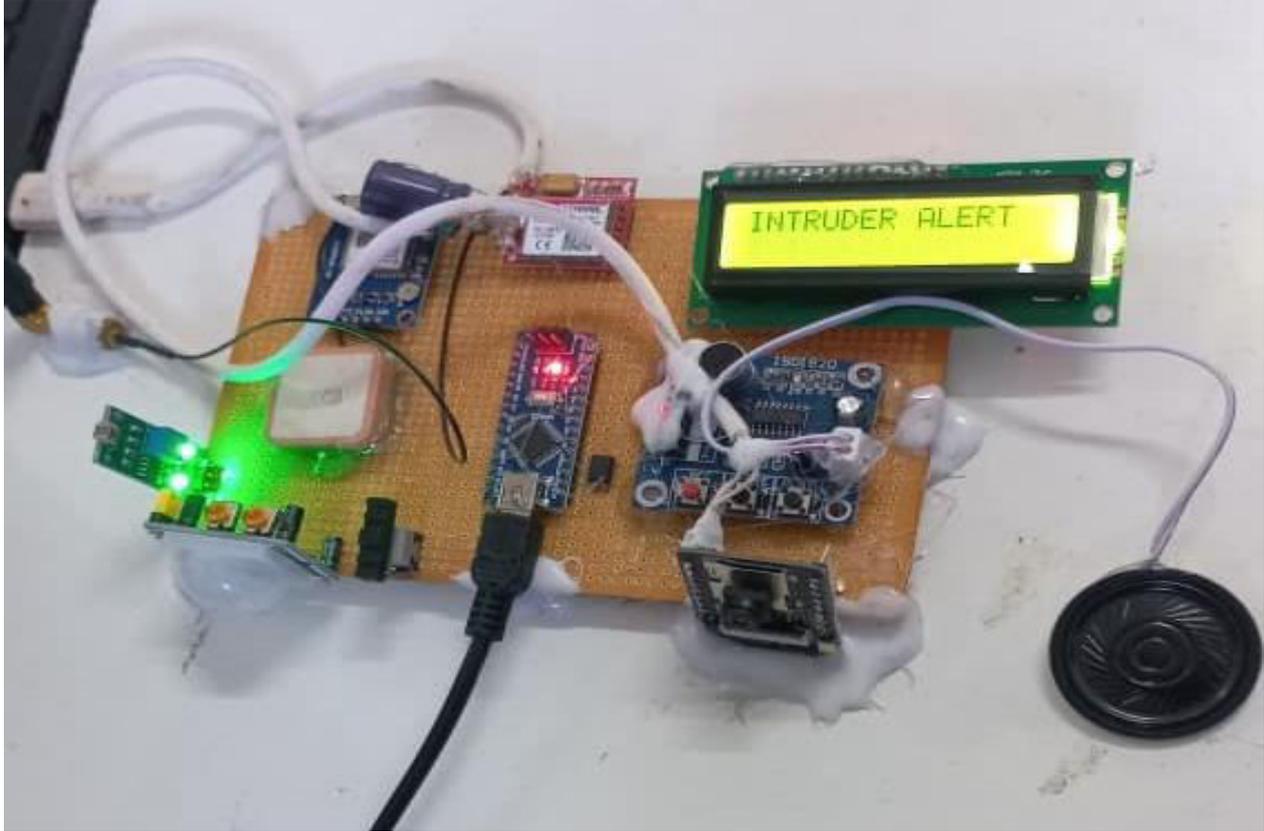


Flowchart:



IV. EXPERIMENTAL RESULTS

- Intruder Detection: The PIR Sensor successfully detected human movement, triggering the Arduino Nano to update the LCD with an "INTRUDER DETECTED!" message.
- Remote Alerting: The GSM Module reliably sent SMS alerts and calls to the mobile station immediately upon sensing a breach.
- Wheelchair Control: The Voice Recognition Module accurately translated vocal commands into directional movement via the L298N Motor Driver and DC motors.
- Safety & Stability: Ultrasonic sensors effectively prevented collisions in the wheelchair prototype, while stable power management ensured consistent performance across all systems.



V. CONCLUSION

The project successfully realized a cost-effective security system by combining PIR sensors and GSM technology to provide real-time alerts without requiring internet connectivity. Through instant SMS notifications, the system ensures a quick response to unauthorized motion, making it highly reliable for remote or low-infrastructure areas. Its low power consumption and modular design allow for continuous 24/7 operation and easy future expansion with IoT or camera modules. Ultimately, the prototype provides a dependable and user-friendly security solution for residential and commercial applications.

REFERENCES

1. Abdullahi, Y., et al. (2026). Reliability of GSM-Based Alert Systems in Low-Connectivity Environments. This study proved that GSM modules (SIM800L) provide more secure alerting than Wi-Fi because they are independent of local internet infrastructure.
2. Sarhan, M., et al. (2025). Smart Security Systems: Reducing False Alarms in PIR Sensors. Their research focused on refining PIR sensitivity and utilizing mobile platforms for immediate intruder notification.
3. Narender, K., et al. (2025). Comparative Analysis of Motion Sensing Technologies for Home Security. This paper confirmed that PIR sensors are the most cost-effective and power-efficient method for detecting human presence via thermal signatures.
4. Jagdale, A. A. (2026). Intruder Detection with GSM Alert: Working Flow and Methodology. This project successfully integrated Arduino Nano, PIR sensors, and GSM modules to create an offline, real-time security solution.



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