IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 5, March 2025

# IoT Based Home Monitoring System

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**Abstract:** *Security is a critical aspect of modern living, and with advancements in technologies like IoT, smart home systems have become more accessible and effective. This project presents a Smart Home Security System utilizing Arduino and IoT to monitor and detect intrusions, water leaks, and abnormal temperatures. Upon detecting any abnormal activity, the system sends an SMS notification to the user. The system allows remote, real- time monitoring via a cloud -based app, providing flexibility and peace of mind regardless of the user's location. The key aspect of the project is its affordability, making it feasible for widespread use in households.*

**Keywords:** IoT, Home Automation, Smart Home, Home security, Remote Monitoring, Sensor Network, Smart sensors, Wi-Fi, Data Analytics, Smart Devices, Smart Management, Home Safety

## I. INTRODUCTION

In recent years, home security has become a top priority for homeowners, business owners, and even renters due to the rising concerns about safety, property damage, and potential loss. With rapid advancements in digital technology, the concept of a "smart home" has gained widespread popularity, primarily due to its ability to integrate various systems for comfort, convenience, and security. Among the most important smart home applications is security, and the Internet of Things (IoT) plays a critical role in making homes more secure, efficient, and easier to monitor.

Traditional security systems often involve expensive installation processes, require human intervention, and provide limited real- time functionality. They might consist of alarm systems or security guards, but they don't offer the flexibility and real-time, remote monitoring that today's IoT-based systems provide. Additionally, many traditional systems lack the capability of notifying the homeowner in a timely manner or offering actionable data, especially when the homeowner is away from the property.

This project addresses these gaps by designing and developing a Smart Home Security System using Arduino and IoT technologies, which can monitor and detect common home threats such as intrusions, water leaks, and fire hazards. The system uses a combination of sensors to monitor the environment and, in case of any anomalies, sends real-time alerts to the user through SMS. It integrates easily with cloud services, allowing the user to monitor their home's security status remotely via a mobile app or web interface. This real-time monitoring and alert system provides the user with peace of mind, knowing they can stay informed and respond quickly, regardless of their location.

## II. LITERATURE SURVEY

| Sr no | Title of paper | Author name | IEEE journal s/conf erence |
|---|---|---|---|
| 1 | which allowed users to monitor environmental conditions like temperature and humidity via cloud integration. | Laxmi Jadhav | (2018) |
| 2 | created a low- cost home monitoring solution with basic sensors for low-income households, focusing on affordability but lacking Advanced features like video surveillance | Indrajit Patil et al | (2017) |
| 3 | Took a predictive approach by integrating machine learning with IoT sensors to detect security threats preemptively, although this complexity and associated costs limited the system's accessibility for widespread use. | Moha mm- ad Asadul Hoque and Chad Davids on | (2019) |

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## III. METHODOLOGY

The proposed IoT-Based Home Monitoring System methodology aims to address the limitations of traditional home monitoring systems by implementing an efficient, real-time, and remotely accessible solution. The following steps outline the methodology for solving the identified

**1. System Design and Integration**

The system integrates various IoT sensors (e.g., PIR motion sensor, temperature and humidity sensor, gas sensor, and water leak sensor) with a central microcontroller, such as the NodeMCU ESP8266, to collect and process environmental data. The NodeMCU manages data communication between sensors and the cloud platform, creating a centralized system for real-time home monitoring.

**2. Cloud Connectivity for Real-Time Monitoring**

Using a cloud platform (such as ThingSpeak, Firebase, or Blynk), the system transmits sensor data to a secure, accessible environment. This enables real-time monitoring and storage of data, allowing users to track home conditions from anywhere through a mobile app or web interface. The cloud connection also supports data logging, enabling users to analyze historical data for trends and insights.

**3. Alert System for Immediate Notifications**

In the event of abnormal conditions (e.g., gas leak, unauthorized entry, or water leak), the system immediately sends alerts to the user's smartphone via push notifications or SMS. This approach ensures prompt notifications, allowing users to take quick action, even if they are not on the property. Configuring threshold levels for alerts (such as temperature limits) provides flexibility to

**4. Remote Access and Control**

Through the mobile app or web platform, users can remotely control connected appliances (e.g., lights or fans) via a relay module integrated into the system. This capability offers users convenience and energy savings by allowing them to manage appliance usage based on real-time sensor data.

**5. Testing and Calibration:**

The sensors and system components will undergo a testing phase to ensure accuracy in detecting environmental conditions and triggering alerts appropriately. Regular calibration of sensors is also performed to maintain reliable operation and prevent false alarms.

**6. Scalability and Customization:**

The system is designed to be highly flexible and scalable, allowing users to add additional sensors, devices, or features based on specific requirements. This modular approach ensures that the system can grow with changing user needs, whether it be adding security cameras, smoke detectors, or integrating with voice
assistants for enhanced home automation.

**7. Energy Efficiency and Low Maintenance**

Low-power sensors and optimized communication protocols will minimize power consumption, making the system suitable for long-term use with minimal maintenance. Battery backups or low-power modes can be implemented to ensure continuity during power interruptions, particularly in critical sensors.

**Objective**

- Home Automation: Controls lights, fans, and household appliances.
- Security Systems: Detects unauthorized motion and gas leaks.
- Energy Management: Automates appliances for efficient energy use.
- Health Monitoring: Monitors temperature, humidity, and air quality.

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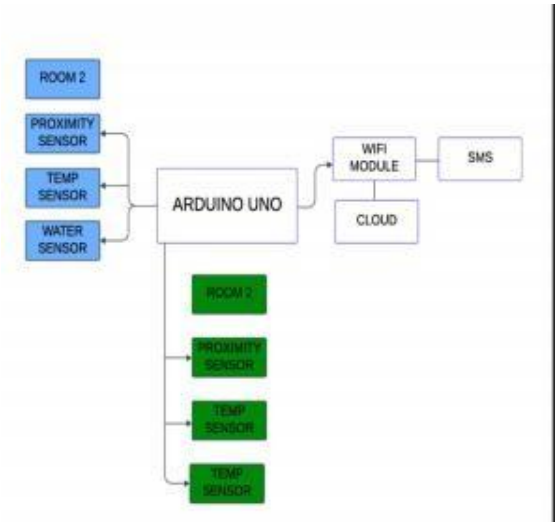
- Industrial Automation: Controls machinery and processes in industries.
- Agriculture: Monitors environmental conditions for crops.
- Educational Projects: Useful for learning IoT, sensors, and automation.

**Problem Definition**

With the increasing demand for safety, convenience, and energy efficiency, traditional home monitoring systems are limited in their ability to provide real-time, remote access, and seamless integration with modern smart technologies. Conventional systems often require expensive installations, human intervention, and lack the flexibility needed for continuous monitoring and instant alerting when users are away from home. Furthermore, these systems typically operate in isolation, offering limited scalability and minimal customization options, making it challenging to meet the diverse needs of homeowners. The IoT -Based Home Monitoring System aims to address these limitations by creating a low- cost, scalable, and efficient solution that allows homeowners to remotely monitor and control various aspects of their homes, including security, environmental conditions, and appliance control. By integrating IoT technology with cloud connectivity and a range of sensors (e.g., temperature, humidity, motion, and gas sensors), this system enables real-time data transmission and alerts, providing users with up-to-the-minute updates on home status through a smartphone app or web interface. The goal is to enhance security, ensure timely response to potential hazards, and optimize energy use, ultimately providing a comprehensive, user-friendly, and customizable solution that aligns with the needs of modern households

**Flow Chart**




**Functional Requirements**

**Hands-Free Control:**

By integrating with Google Assistant and Sinric Pro, users can control lights and fans using voice commands, making it highly convenient

**Remote Access:**

Control your home appliances from anywhere in the world using the Sinric Pro app, provided you have an internet connection.

**Energy Efficiency:**

Automated control reduces the risk of leaving appliances on when not in use, potentially lowering electricity bills.

**Scalability**

The system can easily be expanded to control additional devices and appliances.

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**Cost-Effective:**
Using a NodeMCU ESP8266 with a 4channel relay is much cheaper than commercial smart home systems.
**User-Friendly Interface:**
Sinric Pro and Google Home apps offer intuitive interfaces for controlling devices.
**Smart Home Integration:**
Compatible with popular smart assistants like Google Home and Amazon Alexa for seamless integration.
**Customization:**
Easily customizable and upgradable with additional sensors like motion detectors, temperature sensors, or smart scheduling.

**Non-Functional Requirements**
**Internet Dependency:**
The system relies on a stable internet connection. Without it, remote control and voice commands will not function.
**Privacy Concerns:**
Hands-Free Control: By integrating with Google Assistant and Sinric Pro, users can control lights and fans using voice commands, making it highly convenient.
**Remote Access:**
Control your home appliances from anywhere in the world using the Sinric Pro app, provided you have an internet connection.
**Compatibility Issues:**
Requires specific devices (NodeMCU ESP8266 , Sinric Pro platform) to function correctly; may not be compatible with other IoT ecosystems.
**Power Supply:**
The NodeMCU and relay module require continuous power, which might be an issue during power outages.
**Limited to Basic Appliances:**
Not all household appliances are compatible with simple relay-based controls.
**Technical Knowledge:**
Users need a basic understanding of electronics and programming to set up and troubleshoot the system.
**Manual Override:**
If the internet or Wi-Fi is down, controlling appliances via the app or voice may not be possible, requiring manual switching.

## IV. CONCLUSION

An IoT-based home monitoring system integrates various smart devices and sensors to enhance the security, energy efficiency, and overall management of residential environments. By connecting these devices through the Internet of Things (IoT), homeowners can remotely monitor and control their homes, leading to increased convenience and safety. This article discusses the challenges and potential solutions for creating a natural language interface for smart home devices.

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