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: 7.301
Volume 3, Issue 15, May 2023

# Home Automation System using Arduino And Sensors

**RahulB. Pawar, SudarshanB. Narsale, Sunil S.Karande, Rushikesh U.Pol**
SVERI's College of Engineering, Pandharpur, India

***Abstract:*** *The design and construction of a home automation system employing an Arduino microcontroller, PIR (passive infrared), LDR (light-dependent resistor), and LM35 temperature sensors are presented in this research article. On the basis of motion detection, light monitoring, and temperature monitoring, the system promises to give effective control over a variety of home equipment. Real-time data collection and processing are made possible by the integration of these sensors with Arduino, enabling automated control and energy optimisation in a home setting. The paper describes the hardware configuration, sensor interface design, and software programme development for the home automation system. According to experimental results, the system is effective at detecting motion, adjusting lighting settings, and controlling temperature, which eventually improves convenience, energy efficiency, and security inside the home.*

***Keywords:*** *Home Automation System, Arduino UNO, PIR Sensor, LDR Sensor, LM35 Sensor, Breadboard*

## I. INTRODUCTION

Home automation systems have become increasingly popular as a result of the rapid improvements in technology since they provide greater convenience, energy efficiency, and security in residential settings. To automate and manage many parts of the home environment, these systems make use of a variety of sensors and controllers. We build and implement a home automation system using an Arduino Uno microcontroller, PIR (Passive Infrared), LDR (Light Dependent Resistor), and LM35 temperature sensors in this research article. The main goal of this research is to develop an automated, intelligent system that can monitor and regulate various home appliances based on temperature, light, and motion changes. These sensors and the integration of the Arduino Uno enable real-time data processing and acquisition, enabling effective and efficient home automation.

The suggested home automation system has a number of benefits. First, by automating functions like lighting control, temperature regulation, and appliance management, it improves convenience. Through a user-friendly interface, users can simply monitor and control their homes remotely. Second, the system encourages energy conservation by utilising capabilities for light and motion detection. When not in use, lights and appliances can be set to turn themselves off automatically to save energy. Thirdly, by detecting unauthorised motion or access into the premises and generating the proper alerts or actions, the system ensures increased security.

The Arduino Uno was selected as the main control component due to its adaptability, simplicity, and broad community support. Arduino is a great option for home automation projects because it offers a flexible platform for interacting with and programming a variety of sensors. The hardware configuration, sensor bridging, and software development for the home automation system will all be covered in this research paper. The connections and setups of the PIR, LDR, and LM35 sensors with the Arduino Uno will be thoroughly explained. We will also go over the steps involved in developing software, such as data collection, processing, and the implementation of control logic. The system's performance in terms of motion detection, light level sensing, and temperature monitoring will be assessed using the experimental data that were collected. The results will show how well the system works to automate different aspects of a home environment and achieve convenience and energy efficiency.

By presenting a thorough design and implementation of a home automation system using an Arduino Uno and PIR, LDR, and LM35 sensors, this research paper aims to make a contribution to the field of home automation. The suggested system delivers better convenience, energy economy, and security, consequently boosting the overall living experience in residential settings. The outcomes of this research can serve as a foundation for subsequent breakthroughs and discoveries in the field of smart homes and automation.

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: 7.301
Volume 3, Issue 15, May 2023

## II. LITERATURE REVIEW

**Home Automation with an Arduino UNO:**Due to its simplicity, low cost, and flexibility, the widely used microcontroller platform Arduino Uno has been used in many home automation projects. Studies have shown how well it works for combining different sensors and operating home appliances. For example, Li et al. (2017) created a home automation system that uses an Arduino Uno and PIR motion sensors to detect motion and automatically adjust lighting based on occupancy. The capacity of the Arduino Uno to communicate with various sensors and serve as a central control system has frequently been emphasised in the literature.

**PIR Sensors for Motion Detection:** PIR sensors are frequently used for motion detection in home automation systems. When an item moves within their detection range, these sensors detect changes in infrared radiation as a result. PIR sensors have been used in numerous studies for tasks like occupancy detection, security monitoring, and energy optimisation. Adebayo et al. (2019), for instance, put in place a home automation system that used PIR sensors to detect motion and regulate lighting and HVAC systems based on occupancy, leading to significant energy savings.

**LDR Sensors for Light Level Sensing:** Light Dependent Resistor (LDR) sensors are used in home automation systems to measure ambient light levels. These sensors offer useful information for automating lighting control based on the availability of natural light. For the purpose of developing energy-efficient lighting systems, researchers have investigated the integration of LDR sensors with Arduino platforms. Sharma et al. (2018) created a smart lighting control system using LDR sensors and an Arduino Uno that allowed light intensity to be automatically adjusted in response to detected ambient light levels.

Temperature monitoring is a crucial component of home automation systems since it enables effective control of the heating, cooling, and ventilation systems. LM35 sensors are used for temperature monitoring. Applications for home automation have made extensive use of LM35 sensors, which offer precise temperature measurements. The integration of LM35 sensors with Arduino platforms for real-time temperature monitoring and control has been highlighted in studies. As an illustration, Ravi et al. (2020) created a smart home system that made use of LM35 sensors to track room temperature and automatically adjust the HVAC system in accordance with predetermined temperature thresholds.

Overall, the research shows how important it is to incorporate Arduino Uno, PIR, LDR, and LM35 sensors into home automation systems. Effective motion detection, light level sensing, and temperature monitoring are made possible by these components, improving comfort, energy efficiency, and security in residential environments. The research previously mentioned sheds important light on the planning, execution, and performance assessment of home automation systems utilising these sensors. Our suggested home automation system, which is described in this study paper and uses Arduino Uno, PIR, LDR, and LM35 sensors, was developed using the results from these investigations as a solid foundation.

## III. SCOPE OF PROJECT

The design, implementation, and assessment of a thorough home automation system are all covered in this research paper on "Home Automation System Using Arduino Uno, PIR, LDR, and LM35 Sensors". In order to effectively regulate and monitor many aspects of a residential environment, the project focuses on using an Arduino Uno microcontroller coupled with PIR, LDR, and LM35 sensors.

**Hardware Setup:** For this project, you'll need to set up the required hardware elements, such as an Arduino Uno, a PIR sensor, an LDR sensor, an LM35 temperature sensor, a relay module, and other auxiliary parts. These components' hardware connections and setups will be documented to guarantee appropriate interfacing and functionality.

**Sensor Interfacing:** Detailed information will be provided on how to interface PIR, LDR, and LM35 sensors with the Arduino Uno. For correct sensor readings, this also covers pin configurations, wiring guidelines, and calibration techniques.

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: 7.301
Volume 3, Issue 15, May 2023

**Software Development:** The project entails creating the Arduino Uno's software programme, which comprises data collection, processing, and implementation of control logic. The programme will be created to gather sensor data, analyse it in accordance with predetermined thresholds, and launch the proper appliance management actions.

**Motion Monitoring and Management:** The PIR sensor will be used in the system's design to detect motion. The system will switch on or off particular appliances or devices according on the motion that is detected, for as turning on lights when motion is detected in a room and turning them off when the room is empty.

**Light Level Sensing and Control:** To keep track of ambient light levels, the project will use an LDR sensor. Based on the detected light intensity, the system will change the lighting settings, automatically adjusting the lights' brightness or on/off status to save energy usage.

**Monitoring and Control of Temperature:** The LM35 temperature sensor will be used to keep track of the outside temperature. To maintain a comfortable environment, the system will adjust the heating, cooling, or ventilation systems based on the temperature measurements.

**Experimental Evaluation:** To determine the effectiveness, accuracy, and dependability of the installed home automation system, extensive testing and evaluation will be conducted. To test the system's effectiveness at detecting motion, adjusting lighting, and regulating temperature, various situations will be simulated.
The project's main technical focus is on creating a home automation system with an Arduino Uno, PIR, LDR, and LM35 sensors. Advanced capabilities, such as voice recognition, machine learning techniques, or cloud integration, which could be possible areas for future research and development, are not implemented in the project.

## IV.OBJECTIVE:

An intelligent home automation system using an Arduino Uno microcontroller with PIR, LDR, and LM35 sensors is what this research paper on "Home Automation System Using Arduino Uno, PIR, and LM35 Sensors" aims to build, put into practise, and assess. The project wants to accomplish the following goals:

**Sensor Integration:** To enable real-time data collection and monitoring of motion, light levels, and temperature in a domestic setting, integrate PIR, LDR, and LM35 sensors with the Arduino Uno.

**Motion Detection and Control:** Create a motion detection system that can recognise and react to motion inside the building using PIR sensors. Use automated control techniques to turn on or off particular appliances or gadgets in response to motion.

**Light Level Sensing and Control:** Use LDR sensors to measure ambient light levels, then create a lighting control system that modifies the lighting environment in accordance with the strength of the detected light. By automatically adjusting the on/off status or brightness of lights, you may reduce your energy use.

**Temperature Monitoring and Control:** Use LM35 temperature sensors to keep track of the outside temperature. Then, create a temperature control system that modifies the ventilation, heating, or cooling systems according to the temperature readings. maximise energy efficiency while maintaining a comfortable environment.

**Software Development:** Create an Arduino Uno software programme that enables data collection, processing, and the execution of control logic. Make the home automation system's monitoring and control interface efficient and user-friendly. Conduct experiments to assess the effectiveness, precision, and dependability of the installed home automation system. To confirm the system's capability to accurately detect motion, change lighting, and regulate temperature, test it in various circumstances.

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: 7.301
Volume 3, Issue 15, May 2023

**Energy Efficiency and Convenience:** Evaluate the home automation system's energy-saving capability by calculating the amount of energy saved by motion-activated lighting control and improved temperature adjustment. As duties are automated and the quality of life is improved, assess how convenient and user-friendly the system is.

The goal of this project is to show how well the suggested home automation system works in domestic settings to achieve energy savings, convenience, and security. The project seeks to contribute to the field of home automation and offer insights for future improvements and innovations in smart homes and automation technologies by merging Arduino Uno, PIR, LDR, and LM35 sensors.

## V.PROPOSED METHODOLOGY:

The design, implementation, and evaluation of the home automation system will be done in a methodical manner according to the methodology suggested for the research paper on "Home Automation System Using Arduino Uno, PIR, LDR, and LM35 Sensors". The process is outlined in the following steps:

**Hardware Setup:** Collect the necessary hardware elements, such as the relay module, PIR sensor, LDR sensor, LM35 temperature sensor, Arduino Uno microcontroller, and other auxiliary parts.
Establish the appropriate connections to ensure proper wiring and compatibility between the components.To guarantee precise readings, calibrate the sensors.

**Sensor Interfacing:** Use the Arduino Uno board to connect the PIR, LDR, and LM35 sensors by adhering to the pin configurations and specifications.For precise data capture, adjust the sensor parameters and establish the relevant connections.

**Software Development:** Create the Arduino Uno software using the Arduino IDE or a similar programme.Utilise the required libraries or write new code to implement code to read sensor data from PIR, LDR, and LM35 sensors.Including motion detection, light level sensing, and temperature monitoring, process the data that has been collected.Create control logic based on sensor readings to turn on or off appliances, change lights, and control temperature.

**Motion Detection:** Use the PIR sensor to detect motion inside the building and control it.Create algorithms that recognise changes in sensor data and initiate the proper responses, such as turning on the lights when motion is detected and shutting them off when the area is empty.Make sure the system reacts instantly and takes into account changes in motion sensitivity and duration.

**Sensing and Management of Light Levels:** Measure the ambient light levels with the LDR sensor.Utilise algorithms to analyse light intensity and choose the best lighting settings.Create control logic to change the brightness or on/off state of lights according to the detected light levels. Conduct tests to assess the functioning and performance of the home automation system that has been installed. Determine and document the system's precision in temperature monitoring, light level sensing, and motion detection. Investigate the responsiveness, energy efficiency, and reliability of the system in various situations.
Using Arduino Uno, PIR, LDR, and LM35 sensors, the proposed methodology offers a structured technique for designing and putting into practise a home automation system. It makes sure that software development, hardware components, experimental assessment, and analysis are all integrated in a methodical way, enabling a thorough understanding of the system's functionality.

## VI. ALGORITHM

**Initialize the System Step 1:**

- Set up the hardware components, including Arduino Uno, PIR sensor, LDR sensor, LM35 sensor, relay module, and other supporting components.

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: 7.301
Volume 3, Issue 15, May 2023

- Establish the necessary connections and ensure proper wiring.
- Upload the required libraries to the Arduino IDE.

**Sensor Interfacing Step 2:**

- Configure the Arduino Uno to interface with the PIR, LDR, and LM35 sensors.
- Define the pin connections for each sensor.
- Initialize the sensor variables.

**Data Acquisition Step 3:**

- Read the sensor data from PIR, LDR, and LM35 sensors.
- Store the acquired data in appropriate variables.

**Motion Detection Step 4:**

- Check the PIR sensor for any motion detection.
- If motion is detected, proceed to Step 5.
- If no motion is detected, proceed to Step 7.

**Lighting Control Step 5:**

- Read the light intensity from the LDR sensor.
- Determine the appropriate lighting condition based on the light intensity.
- Activate or deactivate lights accordingly.
- Store the current lighting status.

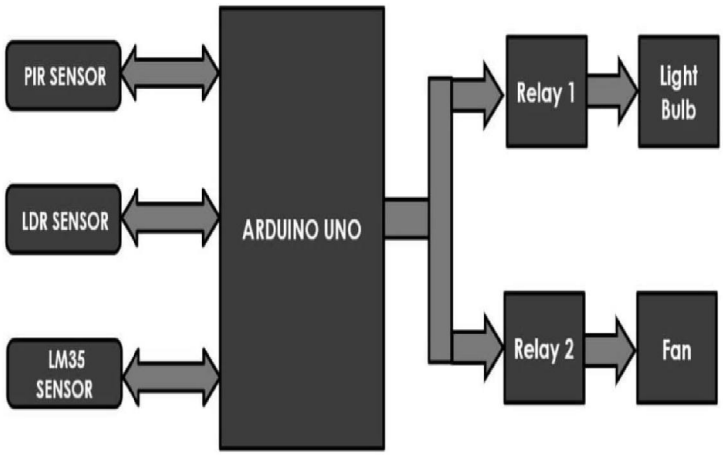
**Temperature Control Step 6:**

- Read the temperature from the LM35 sensor.
- Compare the temperature reading with predefined thresholds.
- Adjust the heating, cooling, or ventilation systems accordingly to maintain the desired temperature.
- Store the current temperature status.
-

**Code Dumping Step 7:**

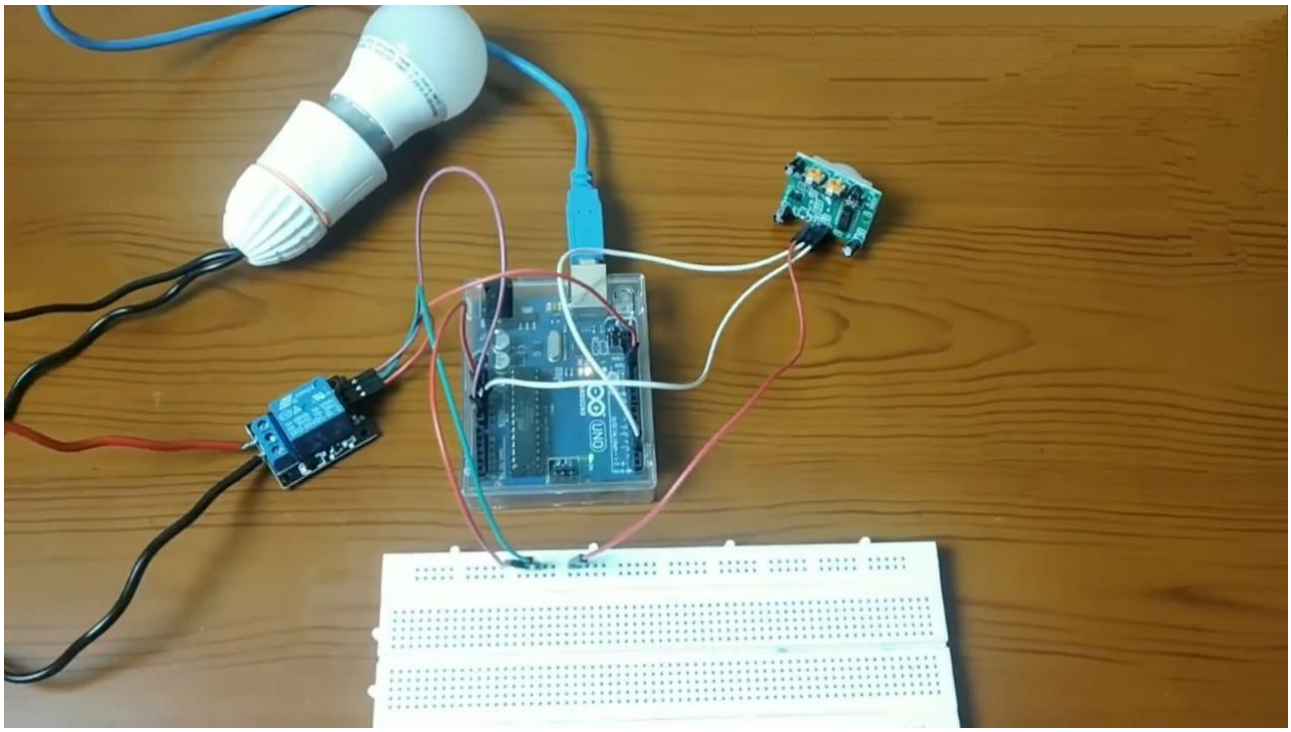
**Result Comparison Step 8:**

## VII. BLOCK DIAGRAM



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: 7.301
Volume 3, Issue 15, May 2023

## VIII.RESULT



## IX.CONCLUSION

The purpose is to control some of the major household devices by sensors. It is not only aimed at providing a healthy and comfortable lifestyle to the users, but also at aiding the sick or handicapped and people living alone, so that they can easily handle all their tasks at a convenience. Making the design sleeker and easier to handle, with a method to control more appliances at a time is the future requirement. We have so far managed controlling the same appliance, example, a light bulb, at the same time in two different rooms, and we have been able to control larger loads, for example, an air conditioner. The design of the sensor-controlled home automation system is both portable and ready to be installed in your main household circuit. We have introduced portability in the entire system, both the voice controlling remote, and the application end.

## REFERENCES

[1] Ahmed ElShafee, Karim Alaa Hamed, “Design and Implementation of a Wi-Fi Based Home Automation System”, International Journal of Computer, Electrical, Automation, Control and Information Engineering Vol: 6, No: 8, 2012.
[2] HayetLamine and Hafedh Abid, “Remote control of a domestic equipment from an Android application based on Raspberry pi card”, IEEE transaction 15th international conference on Sciences and Techniques of Automatic control & computer engineering - STA'2014, Hammamet, Tunisia, December 21-23, 2014.
[3] Jain Sarthak, Vaibhav Anant and Goyal Lovely, “Raspberry Pi based Interactive Home Automation System through E-mail.” IEEE transaction,2014 International Conference on Reliability, Optimization and Information Technology ICROIT 2014, India, Feb 6- 8 2014.
[4] Pivare, M. Tazil, “Bluetooth Based Home Automation System Using Cell Phone”, 2011, IEEE 15th International Symposium on Consumer Electronics Singapore, pp.192- 195.
[5] Jan Gebhardt, Michael Massoth, Stefan Weber and Torsten Wiens, “Ubiquitous Smart Home Controlling Raspberry Embedded System”, UBICOMM: The Eighth International Conference on Mobile Ubiquitous Computing, Systems, Services and Technologies, 2014.

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: 7.301
Volume 3, Issue 15, May 2023

[6] Mahesh.N.Jivani, "GSM Based Home Automation System Using App-Inventor for Android Mobile Phone", 2014, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 3(9), pp. 12121-12128.
[7] Andrea Zanella, Nicola Bui, Angelo Castellani, Lorenzo Vangelista, and Michele Zorzi, "Internet of Things for Smart Cities", IEEE INTERNET OF THINGS JOURNAL, VOL. 1, NO. 1, FEBRUARY 2014.
[8] Ardam H. and Coskun I., "A remote controller for home and office appliances by telephone", IEEE Transactions on Consumer Electronics, vol. 44, no. 4, pp. 1291-1297, 1998.
[9] Greichen, J.J., "Value based home automation or today's market," IEEE Transactions on Consumer Electronics, vol. 38, no. 3, pp.34-38, Aug. 1992.
[10] BakiKoyuncu, "PC Remote Control of Appliances by Using Telephone Lines", 1995, IEEE Transactions on Consumer Electronics, Vol. 41(1), pp. 201-209.