# DAYANANDA SAGAR COLLEGE OF ENGINEERING

**(An Autonomous Institute affiliated to VTU, Belagavi – 590018, Approved by AICTE & ISO 9001:2015 Certified) Accredited by National Assessment & Accreditation Council (NAAC) with ‘A’ grade & NBA**



PROJECT REPORT ON

ADAPTIVE INTELLIGENT CONTROL OF AIR

CONDITIONING SYSTEM WITH HOME

AUTOMATION

Under Bachelor of Engineering in Electrical & Electronics

|  | ***Submitted by*** |  |
| --- | --- | --- |
| **Name of the candidates:** |  | **USN:** |
| Poojith H S  Punith Kumar S M  Rakshit Anand Moktali Srujan S Kashyap |  | 1DS20EE048  1DS20EE051  1DS20EE054  1DS20EE072 |

Under the Guidance of **Ms. Supriya J** (Assistant Professor Department of EEE)

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**DAYANANDA SAGAR COLLEGE OF ENGINEERING**

**Shavige Malleshwara Hills, Kumaraswamy Layout Bengaluru-560078**

**2022-23**

# DAYANANDA SAGAR COLLEGE OF ENGINEERING

**(An Autonomous Institute affiliated to VTU, Belagavi – 590018, Approved by AICTE & ISO 9001:2015 Certified) Accredited by National Assessment & Accreditation Council (NAAC) with ‘A’ grade & NBA**

**Shavige Malleshwara Hills, Kumaraswamy Layout Bengaluru-560078**

**2022-23**

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**



**CERTIFICATE**

Certified that the Project report entitled **"Adaptive Intelligent Control of Air Conditioning System With Home Automation** carried out by **Poojith H S (1DS20EE048)**, **Punith Kumar S M (1DS20EE051)**, **Rakshit Anand Moktali (IDS20EE054)**, **Srujan S Kashyap (IDS20EE072)** a bonafide student of **DAYANANDA SAGAR COLLEGE OF ENGINEERING**, an autonomous institution affiliated to VTU, Belagavi in partial fulfillment for the award of Degree of Bachelor of Engineering in Electrical and Electronics Engineering during the year 2020-2021. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The Project report has been approved as it satisfies the academic requirements in respect of work prescribed for the Bachelor of Engineering Degree.

Signature of the Guide Signature of the HOD Signature of the Principal

Ms. Supriya J Dr. P Usha Dr. BG Prasad

Assistant Professor Professor and HOD Principal

Dept. of E&E Engg. Dept. of E&E Engg. DSCE, Bengaluru

DSCE, Bengaluru DSCE, Bengaluru

**Name of Examiner Signature with Date**

**1. ………………... ………………………**

**2. ………………… ………………………**

**ACKNOWLEDGEMENT**

The joy and satisfaction that accompany the successful completion of any task would be incomplete without thanking those who made it possible. We consider ourselves proud to be a part of Dayananda Sagar College of Engineering, the institution which molded us in all our endeavors.

We would like to express our sincere thanks to Dr. B G Prasad, Principal, who has been a constant

source of inspiration.

We would like to express our gratitude to Dr. P Usha, HOD who has supported us constantly and has

been a great inspiration.

We express our profound gratitude to the coordinators who have given valuable suggestions and guidance throughout the project. We would like to express our sincere gratitude to our guide Prof Supriya.J, Assistant Professor, Department of EEE for her guidance, continuous support and motivation in completing the project successfully.

# ABSTRACT:

We all know that we are slowly moving towards automation which is one of the trending topics. This project aims to develop an automatic AC temperature control system based on ambient temperature using home automation. The proposed system uses a microcontroller- based circuit to collect ambient temperature data from a sensor and adjust the AC temperature settings accordingly. The system is integrated with home automation technology. The system's effectiveness is evaluated through experimentation, which shows that it can maintain a comfortable indoor temperature by reducing energy consumption. The proposed system offers an affordable and convenient way to regulate indoor temperatures by minimizing consumption, making it an attractive solution for homes and businesses alike. Overall, this project provides a practical application of home automation technology to improve energy efficiency and comfort in indoor environments.

# LITERATURE SURVEY:

[1] This paper begins by discussing the importance of temperature control in buildings, particularly with regard to energy efficiency and occupant comfort. This involves the use of machine learning algorithms to optimize temperature control based on a variety of factors, including occupancy patterns, weather conditions, and energy prices including sensors for collecting data, a machine learning model for optimizing temperature control, and a control system for adjusting the temperature based on the model's output.

[2] This paper proposes the use of smart sensors and wireless networks to achieve better control of air conditioning systems. The paper provides an overview of the existing air conditioning systems and their limitations, such as poor temperature and humidity control, high energy consumption, and inadequate monitoring and maintenance. This also highlights the potential of smart sensors and wireless networks for enabling smart air conditioning control and reducing energy consumption in buildings.

[3] This paper presents a smart control system for air conditioning that is based on the number and activity level of persons in the room. The system uses motion sensors to detect the presence and activity level of people in the room and adjusts the air conditioning settings accordingly with the help of a fuzzy logic-based algorithm.

[7] This paper discusses the development of a smart automation system that enables remote control of home appliances using a mobile device. The paper proposes a system architecture that involves a mobile application and a control unit that communicates with the appliances via Wi-Fi. The mobile application is designed to provide a user-friendly interface for controlling the appliances and monitoring their status. The control unit, on the other hand, receives commands from the mobile application and executes them by sending signals to the appliances.

[8] It presents a smart home automation system that uses Internet of Things (IoT) technology to control various household appliances highlighting the growing trend towards home automation and IoT-enabled devices and how these technologies can help make our lives more convenient and comfortable. This involves the use of several sensors and actuators connected to a central controller. The system is designed to be user-friendly and easy to operate through a mobile application, which enables users to remotely control and monitor their appliances from anywhere at any time.

[9] The paper proposes a real-time smart home management system that considers energy saving. Using machine learning algorithms to learn the residents' behavior patterns and adjusts the home environment accordingly. The system employs an Internet of Things (IoT) architecture, allowing for the seamless integration of various smart devices and sensors. It also discusses about the future scope of incorporating renewable energy sources and optimizing the systems for large-scale applications.

[11] This paper presents a study on the use of a novel nanocomposite material based on the flame aerosol synthesis of ZnO nanoparticles for automatic air conditioning control in a domestic household. It discusses the properties of FA-ZnO nanocomposites, including their high surface area, high sensitivity, and fast response time, which make them suitable for use as smart sensing materials.

[12] It explains the approach for optimizing the energy consumption of air conditioners in IoT-enabled smart homes based on a combination of occupancy-based and temperature-based control strategies. The occupancy-based control strategy involves using occupancy sensors to detect the presence of people in the home and adjusting the temperature and humidity levels accordingly.

[13] The paper presents an online model for indoor temperature control based on the building thermal process by taking into account the thermal mass and thermal resistance of the building, as well as the thermal dynamics of the air conditioning system. It uses a grey-box modeling approach that combines physical and data-driven models.

At presents a smart home energy management system that uses ambient temperature and occupancy data to control AC systems. The system can that take into account user preferences and energy consumption. A smart home automation system that includes an automatic temperature control system based on ambient temperature. The system uses IoT sensors to detect changes in temperature and automatically adjusts the AC system to maintain a comfortable environment this can including occupancy-based and learning-based approaches, and highlight the importance of energy-efficient systems that take into account user preferences and behavior. The recent research on automatic AC controllers with home automation has shown that it is possible to optimize energy consumption while maintaining a comfortable environment. The use of sensors, controllers, and algorithms allows for learning and adaptation to the changing conditions and the user's preferences. The proposed systems can result in energy savings, which is a significant contribution to the reduction of greenhouse gas emissions and the energy bills.

# OBJECTIVES:

1. To Increase energy efficiency: Home automation-based automatic AC controllers can optimize energy usage by automatically adjusting the AC settings based on occupancy, temperature, and time of day. This can lead to significant energy savings and reduce energy bills.
2. To Enhance comfort: Home automation-based automatic AC controllers can provide personalized comfort by adjusting the temperature, fan speed, and other settings according to individual preferences. This can help to create a more comfortable living environment without requiring manual intervention.
3. To Increase convenience: Home automation-based automatic AC controllers can make it easier to control the AC system by automatically adjusting settings based on user preferences and environmental conditions. This can provide greater convenience and flexibility for homeowners.
4. To Reduce carbon footprint: Home automation-based automatic AC controllers can help to reduce the carbon footprint of the household by optimizing energy usage and reducing wasteful consumption without requiring manual intervention.

# SOLUTIONS FOR PROBLEMS:

## Energy consumption

Energy Efficiency: An Automatic AC Temperature Control System based on Ambient Temperature with Home Automation can provide significant energy savings by automatically adjusting the AC temperature based on the ambient temperature in a room. This can help reduce energy consumption while maintaining a comfortable environment for occupants.

## Difficult or complex system

Convenience: The system can be designed to provide greater convenience to users by allowing them to control the AC temperature remotely using a smartphone app or other home automation interface. This can allow users to adjust the temperature from anywhere in the house.

## Not specific to users

Customization: The system can be customized to meet the unique needs of individual users or households. For example, the system can be programmed to adjust the temperature based on AC configuration, efficiency, occupancy, or other factors.

## Different systems

Integration: The system can be integrated with other home automation systems, such as lighting and security systems, to provide a more comprehensive and seamless user experience. This can provide greater control over the environment.

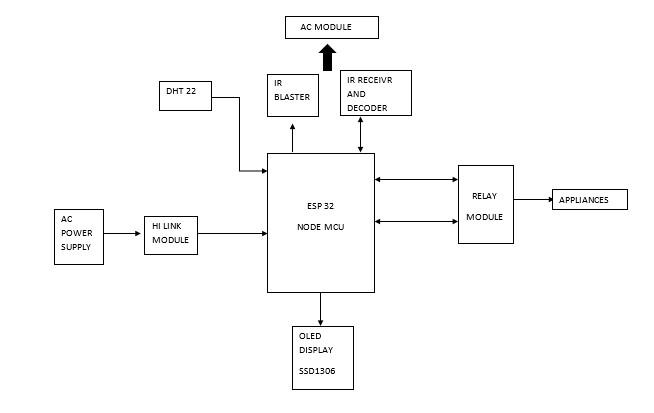
## Costly to install

Cost-effectiveness: An Automatic AC Temperature Control System based on Ambient Temperature with Home Automation can be designed to be cost-effective by using energy- efficient components and minimizing installation and maintenance costs. This can help make the system accessible to a wider range of users and households.

# METHODOLOGY:

In this project we will using IoT technology along with sensors and other components. The methodology will be following a process where a microcontroller (esp) will act as our brain of the system ,first we will be considering a AC system where we decode the signals of the remote using a tsop1838 sensor and we will using a dht22 sensor to find out the ambient temperature of the room which will be fed back to the microcontroller and here we will be writing a program to change the ac temperature based on the ambient temperature using a IR blaster which will change the AC temperature accordingly. Also we will be integrating other components for home automation.

# BLOCK DIAGRAM:

****

**Working of the Module Responsible for AC Control**

**Explanation:**

* Automatic Temperature Control Circuit that could minimize the electricity charges by varying the AC temperature automatically based on the Rooms temperature. By varying the temperature periodically, we can avoid the working of AC for long hours thus making it consume less power.
* To automate this process this project uses a Temperature sensor (DHT 22) which reads the present temperature of the room and based on that value it will send commands to the AC through an IR blaster similar to the AC’s Remote. The AC will react to these commands as if it is reacting to its Remote and thus adjust the temperature accordingly.
* A **TSOP1838** is an IR Receiver that could be used to decode the signal coming from the Remotes. This Receiver will be interfaced with ESP32 to signal for each button and then an IR Led will be used with ESP32 to mimic the signal whenever required. This way we can gain control over our AC using ESP32.

# COMPONENTS USED:

1. ESP Module
2. Relay Module
3. OLED Screen
4. Connecting Wires
5. Perf Board
6. HI-Link Converter
7. DHT22 Sensor
8. TSOP1838

**Evolution of components:**

**2018:**

# DHT11–Temperature and Humidity Sensor:

Specifications:

* Ultra low cost
* 3 to 5V power and I/O
* 2.5mA max current use during conversion (while requesting data)
* Good for 20-80% humidity readings with 5% accuracy
* Good for 0-50°C temperature readings ±2°C accuracy
* No more than 1 Hz sampling rate (once every second)
* Body size 15.5mm x 12mm x 5.5mm
* 4 pins with 0.1" spacing

### TSOP-1738 IR reciver:

Specifications:

* Minimum and Maximum Input Voltage is -0.3 and 5V respectively. Typically +5V is used.
* Can detect IR signals from Remotes (38kHz)
* Operating current: 5mA
* High Range and wide coverage area.
* Will respond only to IR signals, due to high immunity against ambient light
* Low power consumption
* Has in-built pre amplifier
* TTL and CMOS compatible

**2023:**

# DHT22–Temperature and Humidity Sensor:

Specifications:

* Low cost
* 3 to 5V power and I/O
* 2.5mA max current use during conversion (while requesting data)
* Good for 0-100% humidity readings with 2-5% accuracy
* Good for -40 to 80°C temperature readings ±0.5°C accuracy
* No more than 0.5 Hz sampling rate (once every 2 seconds)
* Body size 15.1mm x 25mm x 7.7mm
* 4 pins with 0.1" spacing

### TSOP-1838 IR reciver:

Specifications:

* Input Supply Voltage: 2.5 ~ 5.5V
* Suitable Transmission Code: NEC code,RC5 code
* TTL and CMOS compatibility.
* Universal receiver. 38 KHz
* Infrared receiver.
* Infrared remote control receiver.
* TL1838 VS1838B. 38khz
* Photodetector and preamplifier in one package.
* Internal filter for PCM frequency.
* Inner shield, good anti-interference ability.
* High immunity against ambient light.
* Improved shielding against electric field disturbance

# APPLICATIONS:

* 1. Home
  2. Mall
  3. Hospitals
  4. Factories
  5. Old Age Homes
  6. School & College
  7. In temperature-controlled testing laboratories
  8. Automatic temperature and humidity control system using air-conditioning in transformer substation.

# REFERENCES:

1. Fontes, F.; Antão, R.; Mota, A.; Pedreiras, P. Improving the Ambient Temperature Control Performance in Smart Homes and Buildings. Sensors 2021, 21, 423. <https://doi.org/10.3390/s21020423>
2. Smart Sensors Enable Smart Air Conditioning Control

Chin-Chi Cheng and Dasheng Lee \*Department of Energy and Refrigerating Air- Conditioning Engineering, National Taipei University of Technology, Taipei 10608,

Taiwan; E-Mail: [newmanch@ntut.edu.tw](mailto:newmanch@ntut.edu.tw) doi:10.3390/s140611179

1. F. Budiman, M. Rivai, I. G. Bagus Prasta Raditya, D. Krisrenanto and I. Z. Amiroh, "Smart Control of Air Conditioning System Based on Number and Activity Level of Persons," 2018 International Seminar on Intelligent Technology and Its Applications (ISITIA), Bali, Indonesia, 2018, pp. 431-436, doi:10.1109/ISITIA.2018.8711311.
2. L. Feng, Z. Hui and T. Yan, "Automatic Temperature and Humidity Control System Using Air-Conditioning in Transformer Substation," 2012 Asia-Pacific Power and Energy Engineering Conference, Shanghai, China, 2012, pp. 1-4, doi: 10.1109/APPEEC.2012.6306942.
3. Adamu Murtala Zungeru, Mmoloki Mangwala, Joseph Chuma, Baboloki Gaebolae, Bokamoso Basutli. Design and simulation of an automatic room heater control system. Heliyon 4 (2018) e00655. doi: 10.1016/j.heliyon.2018. e00655
4. P. Roy, J. Saha, N. Dutta and S. Chandra, "Microcontroller based automated room light and fan controller," 2018 Emerging Trends in Electronic Devices and Computational Techniques (EDCT), Kolkata, India, 2018, pp. 1-4, doi: 10.1109/EDCT.2018.8405090.
5. S. B. M. S. S. Gunarathne and S. R. D. Kalingamudali, "Smart Automation System for Controlling Various Appliances using a Mobile Device," 2019 IEEE International Conference on Industrial Technology (ICIT), Melbourne, VIC, Australia, 2019, pp. 1585-1590, doi: 10.1109/ICIT.2019.8755104.
6. Stolojescu-Crisan, C.; Crisan, C.; Butunoi, B.-P. An IoT-Based Smart Home Automation System. *Sensors* **2021**, *21*, 3784. <https://doi.org/10.3390/s21113784>
7. Elkholy, M.H.; Senjyu, T.; Lotfy, M.E.; Elgarhy, A.; Ali, N.S.; Gaafar, T.S. Design and Implementation of a Real-Time Smart Home Management System Considering Energy Saving. Sustainability 2022, 14, 13840. https://doi.org/10.3390/ su142113840
8. Grassi, B.; Piana, E.A.; Lezzi, A.M.; Pilotelli, M. A Review of Recent Literature on Systems and Methods for the Control of Thermal Comfort in Buildings. Appl. Sci. 2022, 12, 5473. https://doi.org/10.3390/ app12115473
9. Tripathy, H.P.; Pattanaik, P.; Mishra, D.K.; Holderbaum, W. Heat and Moisture Management for Automatic Air Conditioning of a Domestic Household Using FA- ZnO Nanocomposite as Smart Sensing Material. *Energies* **2023**, *16*, 2654. <https://doi.org/10.3390/en16062654>
10. Philip, A.; Islam, S.N.; Phillips, N.; Anwar, A. Optimum Energy Management for Air Conditioners in IoT-Enabled Smart Home. Sensors 2022, 22, 7102. https://doi.org/10.3390/ s22197102
11. Xiuming Li, Zongwei Han, Tianyi Zhao, Jiajia Gao,Online model for indoor temperature control based on building thermal process of air conditioning system,Journal of Building Engineering, <https://doi.org/10.1016/j.jobe.2021.102270>.

PO’s and PSO’s mapping:

| **Batch No.** | **Project Title** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Signature of the Students: Signature of Internal Guide with date: