

HOME AUTOMATION USING Raspberry Pi

By

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Bachelor of Technology
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**ELECTRONICS & COMMUNICATION
ENGINEERING**

BY

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Abstract

This project presents the overall design of Home Automation System (HAS) with low cost and wireless system. It specifically focuses on the development of an IOT based home automation system that is able to control various components via internet or be automatically programmed to operate from ambient conditions. In this project, we design the development of a firmware for smart control which can successfully be automated minimizing human interaction to preserve the integrity within whole electrical devices in the home. We used Node MCU, a popular open source IOT platform, to execute the process of automation. Different components of the system will use different transmission mode that will be implemented to communicate the control of the devices by the user through Node MCU to the actual appliance. The main control system implements wireless technology to provide remote access from smart phone. We are using a cloud server-based communication that would add to the practicality of the project by enabling unrestricted access of the appliances to the user irrespective of the distance factor.

Home Automation:

Node-RED is a visual tool for non-programmers to work with the IoT, it can be used to build applications faster and reduce the “go-to-market” time for IoT products. It can also be used to easily interface hardware devices, APIs, and other online services together in new and interesting ways.

Node-RED can directly access data from microcontroller boards like Arduino, Raspberry Pi using the predefined port number or pin number.

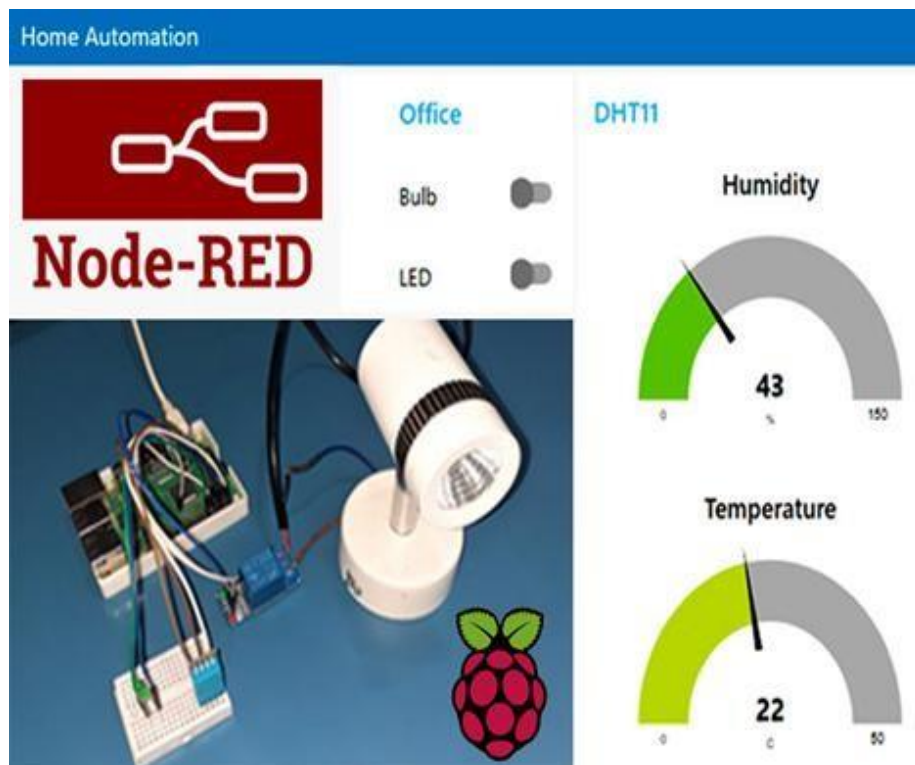
Components for Home Automation using Node-Red:

- Raspberry Pi
- Relay Module
- DHT11 Sensor
- AC Bulb
- LED
- Breadboard
- Jumper Wires

INTRODUCTION

Internet of Things (IoT) is that the foremost evolving technology nowadays. This advancing technology has several applications resembling home automation, information Monitoring. Home automation additionally completely depicts homes inside that nearly everything: appliances, electrical outlets, heating associated cooling systems are snared to a remotely tractable framework. Home automation needs mutual communication of an oversize number of IoT devices. With the considerable rise within the amount of gadgets on the cloud platforms, there's a demand for refreshing microcode fairly often. It includes eliminating already introduced gadgets, creating necessary changes inside the code and flashing the altered code all over again. To beat these issues, process of knowledge ought to be presumably done elsewhere. Node-RED, that may be a visual wiring tool that helps in associating gadgets simply transfer regarding quick and easy affiliation setups. Gadgets are connected along to ESP8266 and a Mosquito primarily based MQTT broker victimization Node-RED and a connection is prepared up for remote watching and control.

Home Automation has been available for a few decades as a result of lighting and basic appliance administration, but it is only recently that technology has caught up with the idea of an interconnected world, enabling full control of the home from any location, becoming a reality and thus establishing a smart home. The term "smart home" relates to a home in which all of the devices are connected to the internet. It can be viewed of as a framework which uses smartphones and computers to manage or communicate with household appliances. Today, the Internet of Things (IoT) has developed into a useful platform for a wide range of applications, including industrial automation, home automation, and medical applications, by connecting different sensors that monitor various device activities and analyzing those data from anywhere.

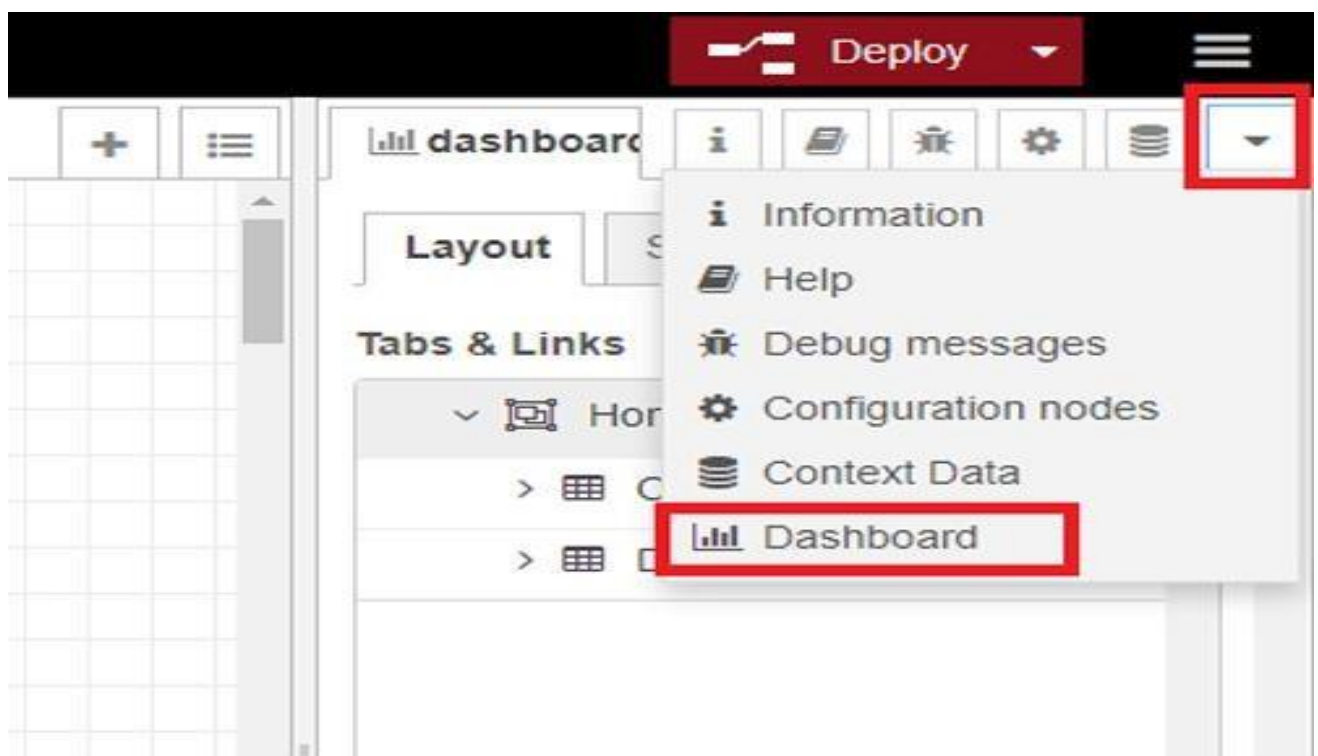


METHODOLOGY

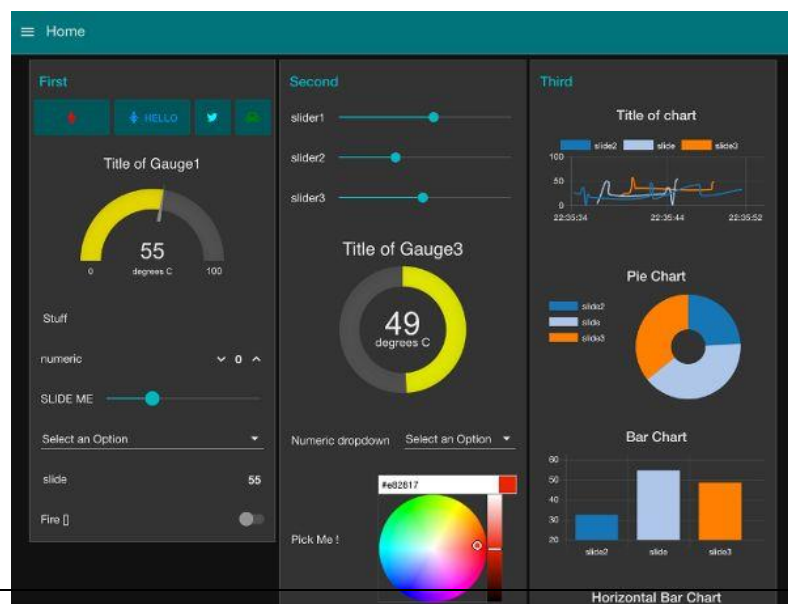
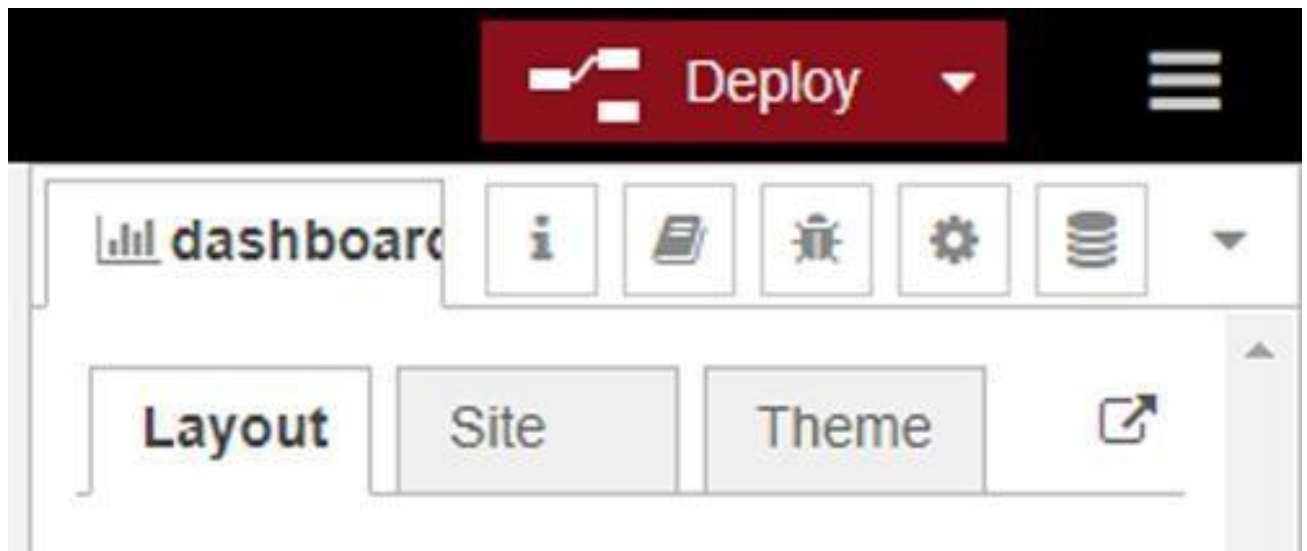
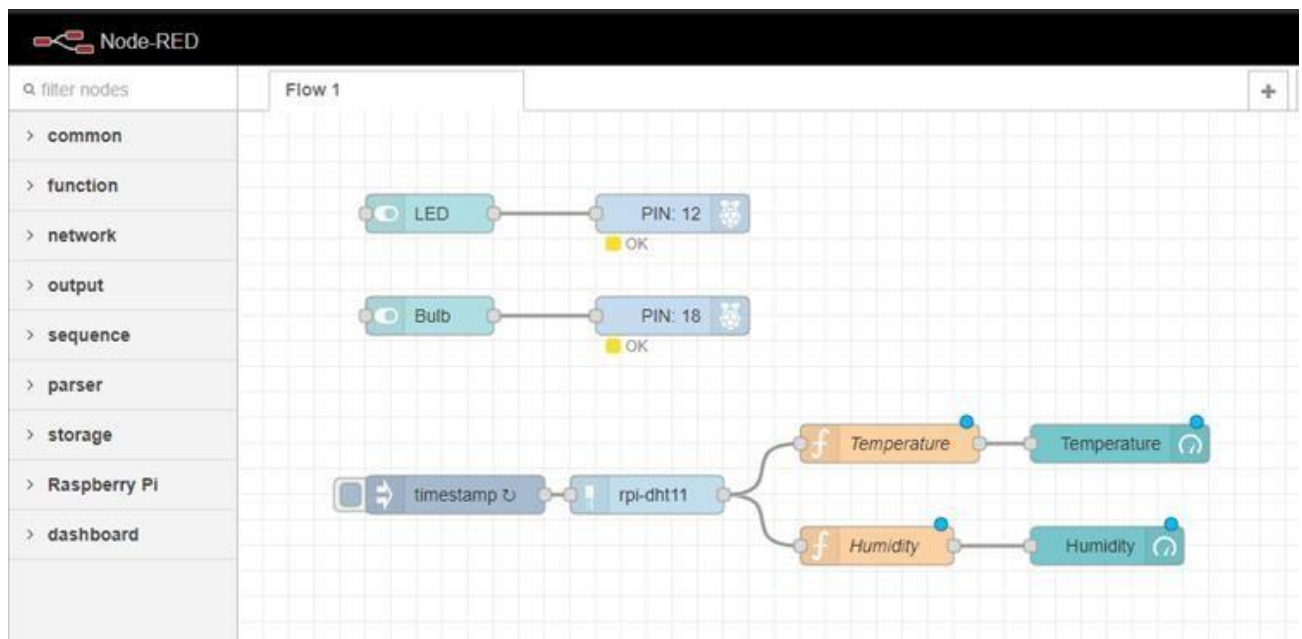
Creating a Flow in Node-RED

With all the required nodes installed, we can proceed with creating a **Node-red flow** to control an LED and read **DHT11 sensor data**. The first step is to create a dashboard layout.

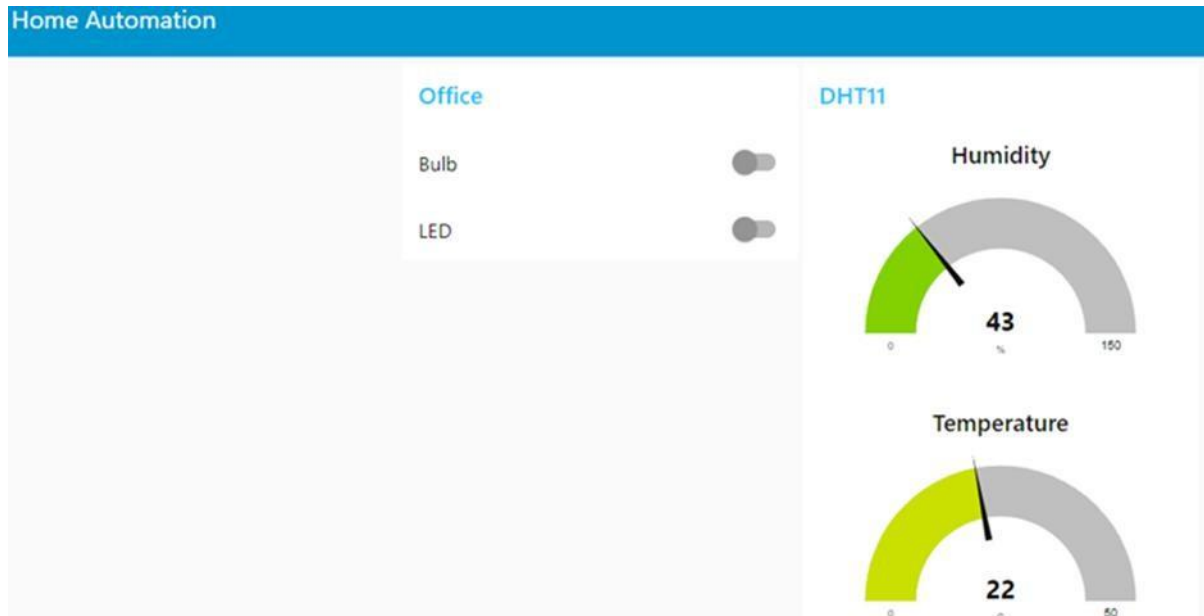
In this project, we'll have two switches to control an LED and bulb; two gauges to display temperature and humidity values. In the top right corner, click on the dropdown menu icon, and select the dashboard tab.



- Then create a tab called “Home Automation” and inside this tab, create two groups: office and DHT.
- Now, go to the Dashboard tab and drag the Switch node into the flow section.
- Now, double-click on the Switch node to edit it. Rename the Switch node as LED. Add Name of Group “Home Automation” for grouping the node.
- Then go to the Raspberry Pi tab and drag the ‘**rpi gpio out**’ node into the flow section.
- Then double-click on the node, select the GPIO18 pin, and select ‘Digital Output’ as the output type.
- Follow the same procedure for adding another switch.
- Now in the next step, add nodes to read DHT11 sensor data. For that, go to the Common node palette and drag the inject node to the flow. Double click on the inject node and then set the interval to every 1 second.
- Then go to the Raspberry Pi tab and drag the rpi-dht22 node to the flow.
- Double click on the rpi-dht22 node and then select the DHT11 as sensor module and 4 in a pin number.
- Now, in the next step, go to the Function tab and drag two functions nodes to the flow as shown below.
- Double click on the function, rename it to Temperature, and then add a line to get only temperature data. Do the same for the second function node to get humidity data.
- Now, in the next step, go to the Dashboard tab and drag two-gauge nodes to the flow.
- Double click on nodes to configure them.
- The final flow will look like this:
- With this done, we are now ready to deploy the project. Click the Deploy button in the top right corner.



Now, to see how the **Node RED dashboard** looks, go to <http://your-pi-ip-address/ui>.

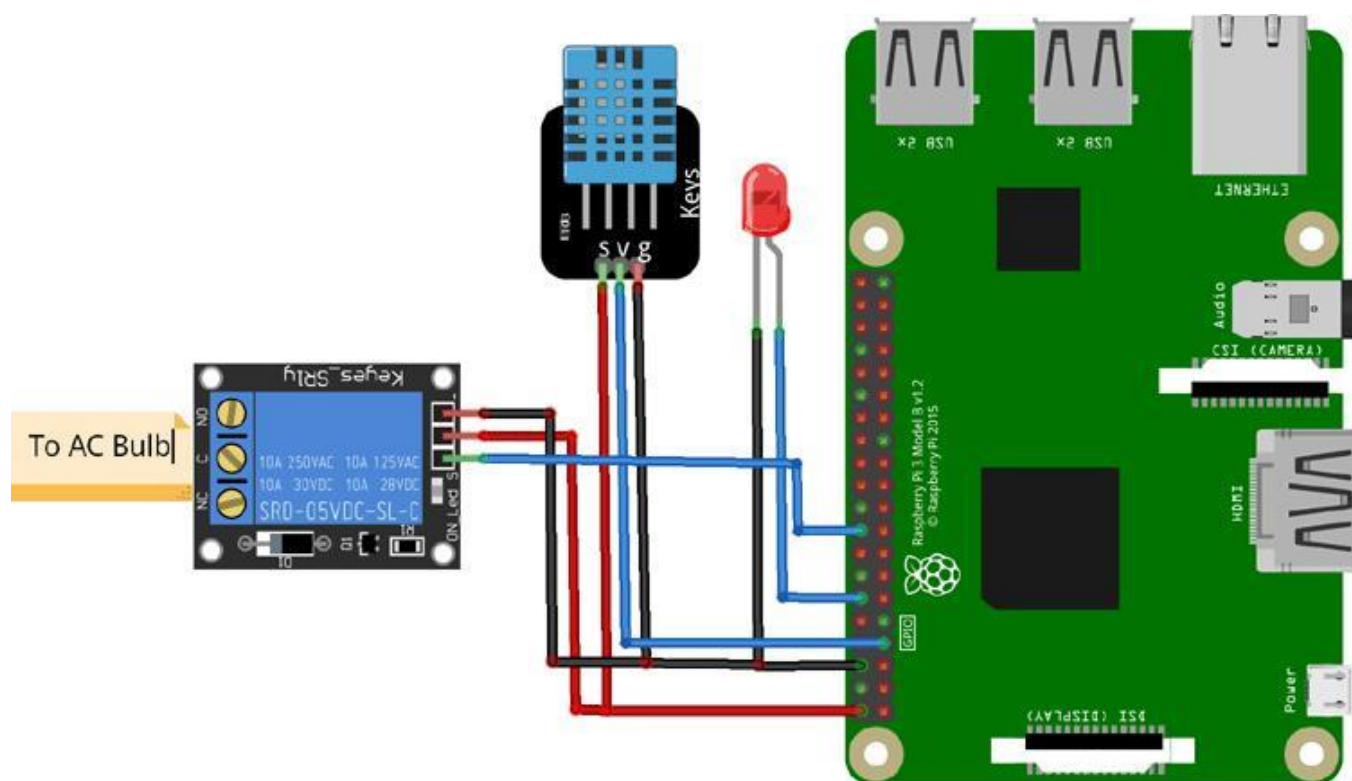
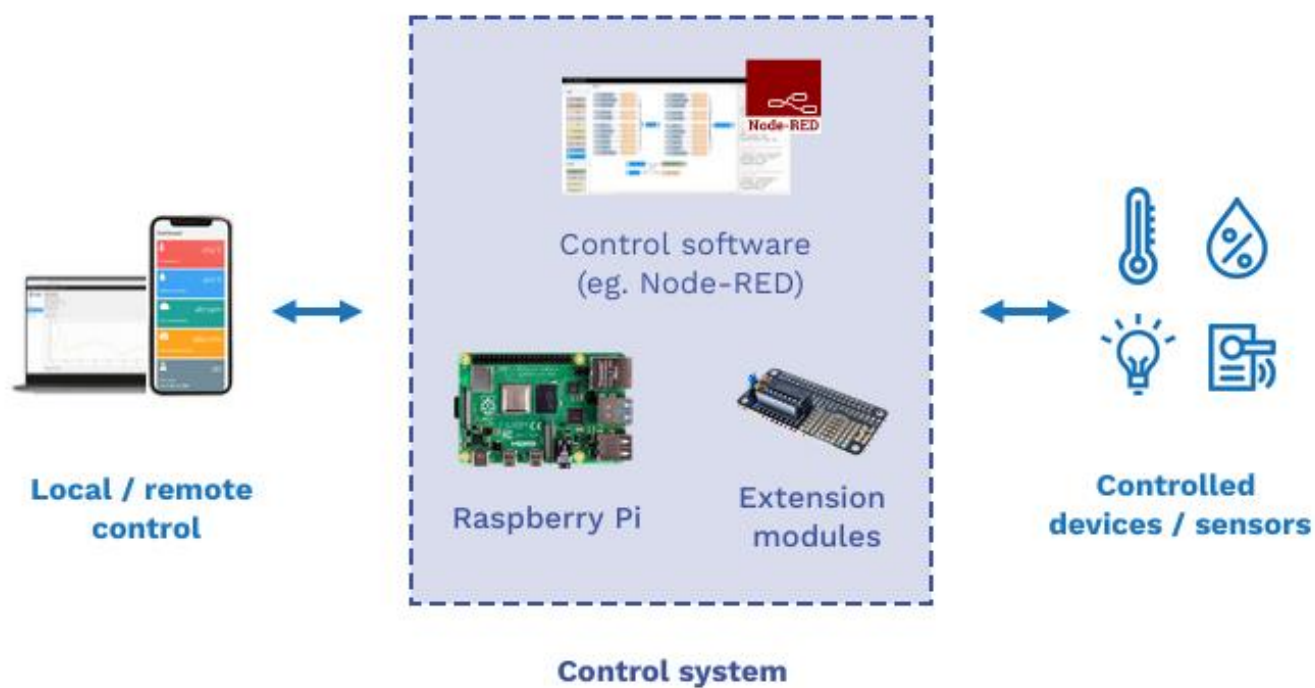


Raspberry Pi Home Automation using Node-Red Circuit Diagram: -

The circuit diagram for Node-RED Home Automation is given below:

The LED is connected to the GPIO18 pin while the input pin of the relay is connected to the GPIO24 pin of Raspberry Pi. The data pin of DHT 11 is connected to GPIO4. When enable is pulled LOW, the module is disabled which means the module will not turn on and it fails to communicate. When enable is left open or connected to 3.3V, the module is enabled i.e., the module remains on and communication also takes place.

Connect the Pi to internet, screen, mouse and keyboard and connect to power. The first thing we will do is enable SSH so we can do the majority of the setup from the comfort on a PC. It can of course be done direct but it helps a great deal to be able to follow this guide on the same device as one driving the Pi and use copy and paste for most of the instructions.



APPLICATIONS

Home Is Where the Smart Is

Even machine-to-machine communication, and you understand you're not the most tech-savvy consumer, it's impossible that you've missed the abundance of home automation products filling the shelves and ads of every home improvement store. Suddenly an ordinary errand for light bulbs will leave you wondering if your lamp could send you a message alerting you that the light bulb needs to be replaced. Furthermore, if your lamp is talking to you, could your refrigerator and sprinkler system be too? Experts say: Yes, the possibilities are endless. If that's the case, where do you begin?

Any day-to-day, repeatable process is automatable with smart home applications. The greater the control and flexibility of these processes, the more energy and cost savings the resident experiences, which are factors anyone who pays utilities strives to moderate. The smart home revolution is likely to be more of an evolution, with the incorporation of one or two home systems at a time, gradually automating our households through smart mobile devices.

However, with these elements of efficiency comes the question of ease of use. Will it bring you enjoyment or exasperation? With so many brands and models already available in an ever-growing market, how do you know which is best for you?

Lighting Control: Leaving the Dark Ages and Stepping into the Light

Smart lighting allows you to control wall switches, blinds, and lamps, but how intuitive is a lighting control system? It turns out, quite; its capabilities are extensive. You're able to schedule the times lights should turn on and off, decide which specific rooms should be illuminated at certain times, select the level of light which should be emitted, and choose how particular lights react through motion sensitivity, as seen with Belkin's WeMo Switch + Motion, which is both affordable and easy to use with its plug-and-play simplicity.

HVAC Regulation: No Longer Burned by Your Heating Bill

As fuel costs rise and the availability and sustainability of our resources becomes a greater concern, heating/cooling our homes efficiently is less a budgetary bonus and more of a necessity. Over the past year, smart thermostats and automated home heating systems have become more readily available and easily incorporate into any home. Heating and cooling our homes consume an average of 50% of energy costs yearly, making daily HVAC regulation progressively rewarding. Maintaining a substantial lead among the nearly non-existent competition, the Nest Learning Thermostat, learns your heating and cooling preferences over time, eliminating the need for programming and is accessible from your smartphone app. With automated HVAC you are able to reduce the heat when a room is unoccupied, and increase or decrease it at specific times based on your schedule and occupancy.

Smart Appliances: What's for Dinner?

Will smart kitchen appliances actually make you a better cook? Maybe. Smart refrigerators, such as LG's Smart ThinQ, allow you to scan grocery store receipts and keep an inventory of your items, and alerts you if an item is about to expire. More impressively, it suggests recipes based on your refrigerator's contents and lets you know when you need to replace items. Smart ovens synch with your smartphone and automatically preheat to the correct temperature based on a recipe selected from your database. While these appliance options seem a bit superficial and convenience based, there is a conservation factor as well. By automating your kitchen appliance and making them accessible from your smart device, you're able to sever the electricity supplied to unused appliances and reduce your energy consumption and costs.

Considering the number of appliances, the average household owns; this could save a substantial amount of money over time.

CONCLUSION: -

The home automation using Internet of Things has been experimentally proven to work satisfactorily by connecting simple appliances to it and the appliances were successfully controlled remotely through internet. The designed system not only monitors the sensor data, like temperature, gas, light, motion sensors, but also actuates a process according to the requirement, for example switching on the light when it gets dark. It also stores the sensor parameters in the cloud (Gmail) in a timely manner. This will help the user to analyse the condition of various parameters in the home anytime anywhere. The approach discussed in the paper is novel and has achieved the target to control home appliances remotely using the WIFI technology to connect system parts, satisfying user needs and requirements. WIFI technology capable solution has proved to be controlled remotely, provide home security and is cost-effective as compared to the previously existing systems. Hence, we can conclude that the required goals and objectives of home automation system have been achieved. The system design and architecture were discussed, and prototype presents the basic level of home appliance control and remote monitoring has been implemented. Finally, the proposed system is better from the scalability and flexibility point of view than the commercially available home automation systems.