



# Home Automation Using Node MCU: A Review

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**Abstract:** Advancements in technologies have developed more interest in automation therefore leading it to be a topic of attraction. Typically, a home network not only consists of devices like laptops, smartphones and tablets but also consists of Home Automation devices which could make human life much easier. One of the central drivers of automation system developments is IoT. IoT has become a great help for the new generation technologies such as Smart Home (SH) and, Embedded Systems.

A simulative example of Home Automation is demonstrated in this project. A home-automated model has been created to give a realistic view of a smart home. The softwares required to build this model are Cisco Packet Tracer (Packet Tracer 8.2.1 Windows 64) and Blender (3.6).

To provide reliable services automation of the home should be adaptable, analytical, and user-friendly. The project states how IoT can help provide a reliable, low-cost, and effective Home Automation System. The main function of the Home Automation System is to collect the sensor data and send it to the currently connected device(s) of the client. Different sensors are being used for achieving various functions of the Smart Home.

The system connects various sensors including NodeMCU and updates their data to the client's logged-in device. This results into a great help for building a system that is automated, cost-effective, user-friendly, and effective power consumption.

**Index Terms** – Smart Home (SH), IoT, NodeMCU, Home Automation, Embedded Systems, sensors, network.

## I. INTRODUCTION

A home is one's dwelling or where one lives, who would not like to have a perfect home? Adding automation to a home can bring you one step closer to a perfect home.

The term Automation states a smart home that would make a human life much easier.

The provision of home automation features, such as automatic fans, lights, sprinkler systems in gardens, temperature monitoring and many more, enables users to satisfy their basic needs in the fast-upcoming life. This results not only in a home that has multiple automated features but also provides to build cost-efficient, user-friendly, effective power consumption systems.

As generations are changing, life will get into a faster pace and if we ignore the use of Home Automation, we shall slow down in approaching the real goals of our life.

The absence of Home automated systems can significantly lead to decreasing work-life productivity, inappropriate use of time, and unnecessary energy consumption in some cases.

Let us Imagine a scenario,

Where two house owners,

Mr Arjun and Mr Dhruv have an automated home and a non-automated home respectively.

Mr Arjun wakes up to the sound of his favourite music playing on his smart speaker. And,

Mr. Dhruv will have to wake up with the sound of a crashing alarm clock. Then,

Mr. Arjun comes home from work and his smart door lock automatically unlocks the door for him. Whereas,

When Mr. Dhruv comes home from work he must find the keys, and then try to unlock the door. This shows how much more pleasant and convenient a home automation system can improve our lives. Numerous chores that would ordinarily need to be done by hand, such as turning on and off lights and fans, modifying thermostats, and locking and unlocking doors, may be automated.

## II. RELATED WORK

As shown in Fig. 1, three main types of architectural style are used:

- (1) Centralized architecture: In this architecture, all the physical nodes are connected through an intermediate node. Moreover, the requests from the application node must pass through an intermediate node. This type of architecture is usually used with resource-constrained smart devices.
- (2) Connected architecture: Physical nodes can process and forward data to intermediate nodes, and application nodes can directly retrieve data from physical nodes.
- (3) Distributed architecture: Intermediate nodes are unnecessary, and every node can process data and communicate with other nodes. [1]

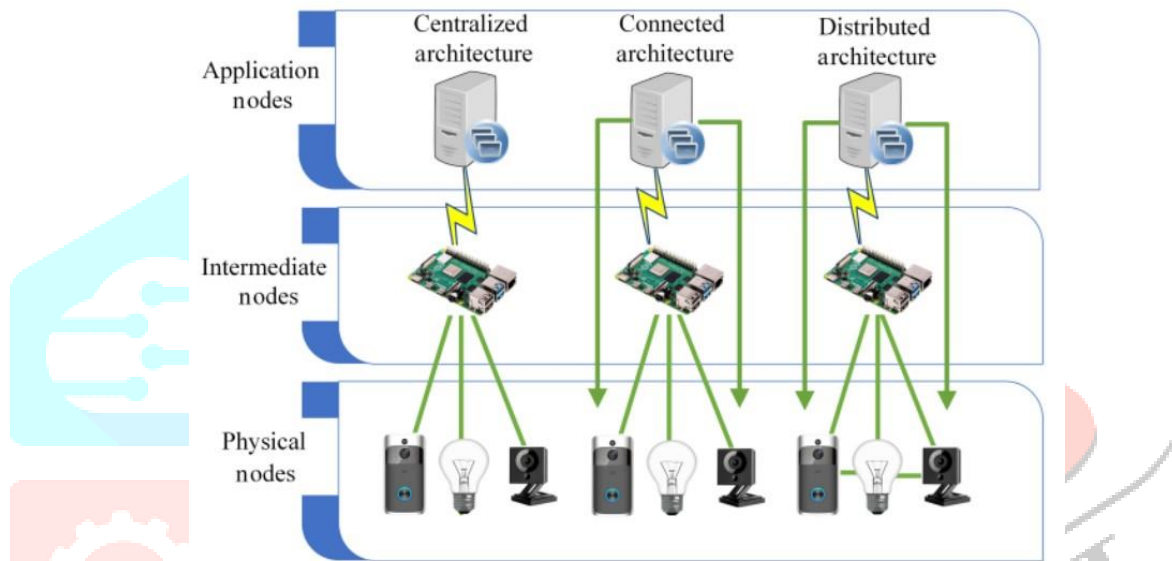


Fig. 1 Architecture styles of the smart home. [1]

## SYSTEM MODEL

The proposed system model consists of four entities: the registration authority, user, gateway, and smart device.

- Registration authority (RA): A trusted authority responsible for the registration of participants.
- Gateway: Manages the collected data in smart devices to provide useful home services for legitimate users. A powerful entity and serves as a bridge between the smart device and legitimate user.
- User: The authorized user by the registration authority can access useful home services through the gateway using a portable device.
- Smart Devices: Devices deployed in smart homes are resource-limited, collect a large amount of real-time data and transmit the collected data to the legitimate user. [2]

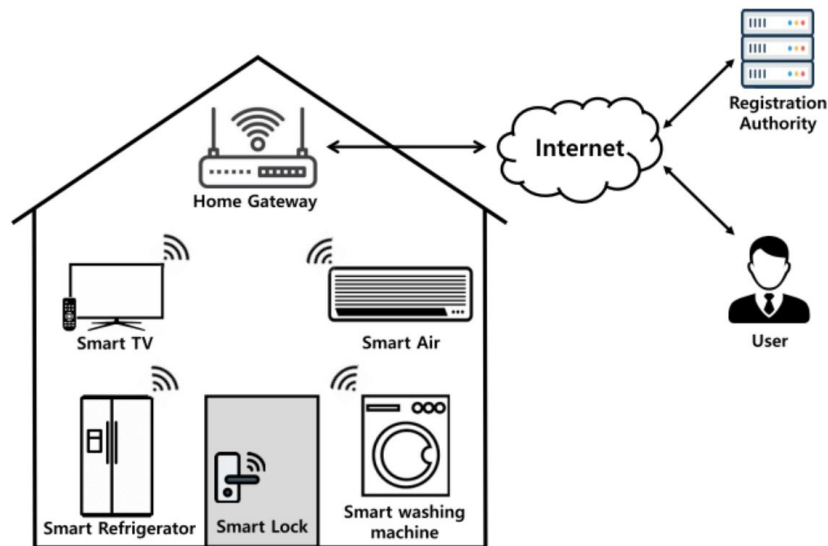


Fig. 2 System Model for IoT- enabled smart homes [2]

Advantages of the proposed system can be analysed from three points of view:

- **Architecture:** As part of an IoT infrastructure, this system can be coupled with different home applications that contribute to implementing a sustainable smart grid and more efficient energy usage.
- **Classification:** This process requires providing a label for each sensor. This label corresponds to the device or appliance connected to the sensor.
- **Consumers:** They will be aware of their electrical consumption and activities and act accordingly to use energy efficiently. [3]

Home Automation systems can be classified into two main categories, namely, local control and remote/global control, which differ based on their concept for operation. Local control systems use an in-home controller with a stationary or wireless communication technology to connect to the central hub or gateway, and users can only control home appliances locally. Remote/global control systems allow users to control home appliances from anywhere over the Internet using their smartphones/laptops. [4]

**Limitations:**

Although our review only included studies with the devices being used by actual participants, to increase comprehensiveness, we did not add any keywords for user studies and manually screened the papers for including those that had user studies.

Further, we did not verify the validity of the methodology and results presented in the reviewed articles and relied on the authors' reports. As there was missing information in some cases, our results on the data type may only reflect the type of data collected and not a proper data analysis on that data. [5]

### III. PROPOSED SYSTEM

Focusing on the future aspect of technologies Home Automation can be one of the solutions that would bring ease to human life.

Focusing not only on technological advancements or growth but also on lower energy bills and, efficiency in energy consumption can be done using Home Automation systems.

The Home Automation System provides the following features:

The base of this system is NodeMCU which supports both Wired and Wireless Bluetooth Connectivity inbuilt and the application named “Blynk” which helps us to operate multiple devices in our home remotely.

The temperature sensor detects the room temperature and accordingly adjusts the speed of the fan.

The LDR (Light Dependent Resistor) sensor detects the intensity of light in the surroundings and accordingly turns ON/OFF the LED lights.

Implementation of Home Automation System:

Blynk software gives access to inbuilt algorithms used to control the components of the Home Automation System.

- Lights and Fans are controlled remotely by inbuilt algorithms.
- Light Dependent Resistor controls the automatic functioning of lights in the garden.
- By using machine algorithms Sprinklers can be accessed remotely.
- The motion sensor will detect any suspicious activity and inform the user.

### IV. SIMULATION RESULTS

Following is the architecture of the proposed system:



Fig. 3 Architecture for NodeMCU-based smart home

FOLLOWING IS THE NETWORKING PROTOTYPE OF THE PROPOSED SYSTEM:



Fig. 4 Garden Water Sprinkler

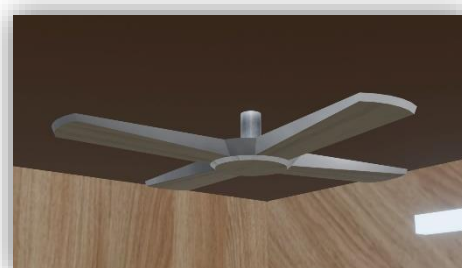


Fig. 5 Fan



Fig. 6 Lights



Fig. 7 Garden Lights

Following is the networking prototype of the proposed system:

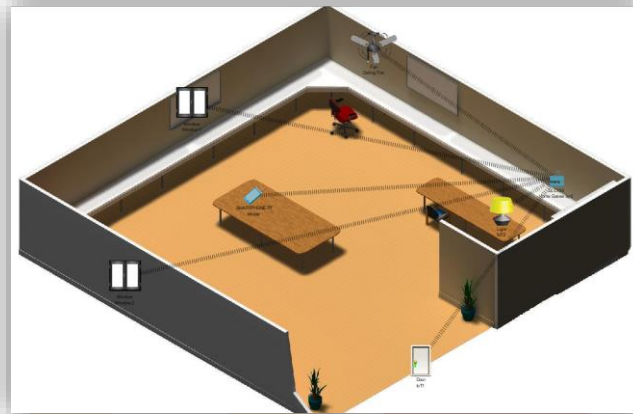


Fig. 8 Networking Prototype

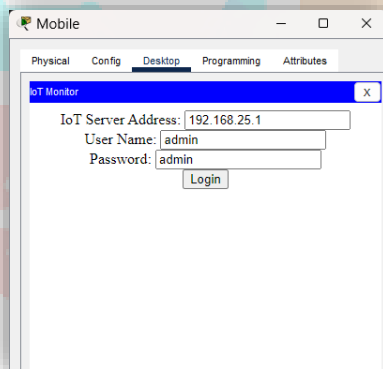


Fig. 9 User Authentication

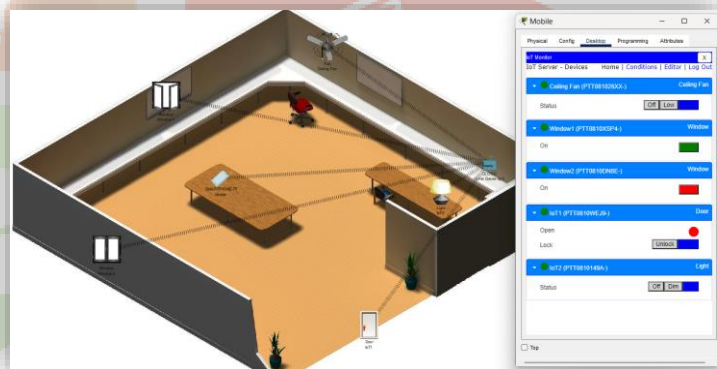


Fig. 10 Access Control

## V. CONCLUSION AND FUTURE WORK

- Overall, the research presents user-friendly working, simulative working, and base concept of the Home Automation System. Features of the system are enhanced due to the proposed methodologies. Real-time monitoring of indoor conditions and appliance control is made possible by the designed IoT Home system, which is simple to install in an actual home. Understanding the real-time operation of the home automation system is made easier by the networking prototype.
- Related work has helped to grasp various aspects and points of view that need to be considered while developing a Home Automation System. Incorporating data and background from several research papers simplifies further topics. To prepare the system for eventual marketing, the developed system can also be upgraded. Additionally, the algorithms utilized to construct the entire system will be discussed. Another point to think about is managing the arrangement of the cables in one location which won't bother the users of the systems while making the changes in the current construction of a home.



- The ultimate goal of the system shall be to build a user-convenient, cost-effective and energy-efficient framework.

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