A Complete Home Automation Strategy Using Internet of Things

Deva Sai Kumar Bheesetti, Venkata Nikhil Bhogadi, Saran Kumar Kintali, and Md. Zia Ur Rahman

Abstract In this cutting-edge world, everyone wants to make their lives simple and secured, which can be accomplished by using Home Automation. It is an inclining word that is getting prevalent on account of its numerous lineaments. The concept of IoT renders the chance of Implementation of Home Automation. Internet of Things makes it possible to control and monitor different devices through the Internet. By connecting the IoT devices to the Internet or Cloud network, users can experience an automated home. The reason for this considerable demand for networkenabled home automation systems is because of their simplicity, comfortability, and affordability. IoT uses several technologies like cloud computing, which is used to connect the IoT devices to different platforms on the Internet and to access them at any time and anywhere in the world. In this project, we are using the Blynk platform to monitor our connected devices through the Internet. It provides us with various widgets and userfriendly interface to control our device. To control our devices with a voice, we are providing access to voice assistants like Google Voice Assistant, Alexa, Cortana, so on through a web-based service called IFTTT (If This Then That). It is an automation platform that provides communication between different web-based services, apps, or devices. In this project, we are implementing a model through which we can control and monitor all the connected sensors and actuators, and we are also connecting them to our voice assistant.

Keywords Arduino · Blynk · Cloud computing · Home automation · IFTTT · Internet of Things (IoT)

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1 Introduction

In this era of modernization, individuals were enamored with smart devices, which can be controlled remotely and can be automated. The community of the Internet of things (IoT) making a smart device more intelligent through innovations [1]. The future IoT and its significant innovations can be identified with digitized sensor advancements, which include Nanotechnology, Miniaturization, and Wireless Sensor Networks (WSN) [9–14]. With the assistance of IoT, considerably being away from home and from anywhere in the world where there is internet connectivity, the client can monitor and control his entrance door, different devices and can make his television to be ON or OFF without his intercession. Later with the development of Cloud-computing and data analysis concepts, which enables smart frameworks to analyze and dissect the information in a progressively proficient way. Through the Internet of Things, we can control appliances remotely with gestures by utilizing motion detection or on-body sensors. Communication is the foundation for the Internet of Things since it is set up by protocols utilized by communication systems assorted with wireless system protocols that are being utilized in digitized home automation. In the IoT systems, a portion of the gadgets is embedded in quotidian items, and in this manner, they must have a small size, limited computational assets, and vitality constraints. IoT can also be integrated with trending technologies like machine learning and artificial intelligence [16–20]. By using these technologies, we are making these devices operate by themselves by analyzing our activities and daily life work. Imagine a smart home with a centralized hub that monitors your stress levels and Temperature of your surroundings through the smart-watch and sets an ambient room temperature suitable for us before we reach our home. A hub which notifies us regarding our daily tasks and controls all the appliances without human intercession even through mobile, A hub which takes decisions on its own through the data from smart-watches, smartphones, and other sensors which we use for our household purpose. In this paper, we discuss designing a system that implements the concept of the Internet of Things to control smart IoT devices that utilize NodeMCU, IFTTT, and Blynk application. The inputs for this system were taken from various sensors and were displayed in the user interface of the Blynk application, and the user gives instructions through widgets in the Blynk app, which were processed to control various smart home appliances through a relay. We can also control these appliances using voice assistants like Google, Cortana, and Alexa. Several signal processing techniques useful in this contest are reported in [21–25].

2 Methodology

2.1 Proposed System

The hardware model mentioned in this paper satisfies the novel requirements of expanding the populace of the present world. The primary advantage of our project is to control different devices which were both electrical and as well as electronic without any effort In this busy world, there may be several works that need our presence at various other places away from our home, and at the same time, we may have to control some device in our house either by turning it ON or OFF, our project comes into handy in such situations. To have control over smart devices wirelessly, these devices have to be connected to the primary server. The client has to create a unique user ID and password and use them to sign in the Blynk application. By doing so, he can control any appliance sparing money, time, and energy. It also provides a secured outright system that collectively provides maximum proficiency since it saves money, time, oversees power utilization, and makes the clients living more secure and astute. We can monitor the readings of a sensor, control the sensitivity of lights, and set timers and scheduling for IoT devices. We can also control our home appliances through our voice assistants like Google voice assistant, Cortana, and Alexa. This feature can be achieved by connecting our voice assistant to our Blynk app through WebSocket service provided IFTTT applets.

2.2 Network Architecture

In any IoT device, the fundamental element is its cloud server. It's the core for all Internet of Things based operations. For this project, we are using the Blynk server for storing data, processing information, and analyzing sensor data. We should make an implicit association between the server and our IoT devices. We can achieve this connection by using end-to-end WebSocket service. Through this web association, we can connect the smart home hub and cloud server through which we can access our IoT devices and make legitimate decisions. To interface the android gadget with the primary server, we have to perform some configurations through our computer [2]. We use Blynk libraries to program our IoT devices, and we use blynk-ser.sh file to connect our device with the Blynk server. We can connect our mobile to the Blynk server through Blynk application, to create a secure environment for this system, the client is provided with a User Id and password, which were created during the device installation. Once these devices are connected to the primary server client can access them through this User Id and password. Hence, he can monitor and control the status of his IoT devices [4–6]. These devices can be accessed by the client through voice assistants by connecting the Blynk server with respective voice assistants. This concept can be achieved by creating an applet in the IFTTT app or website. The entire IoT system has to be online for the proper

working of all the features mentioned above. Here the Internet is the crucial element of the entire network. This proposed model will give simple access and a secured environment if the IoT gadgets and the client are associated with the web [7, 8, 15].

3 System Design

3.1 Software Design

BLYNK. Blynk is an open-source platform that is used to monitor and operate IoT devices remotely. It can be accessed through app stores of both Android and IOS operating systems. Through these applications, users can create a realistic interface to control a hardware model by just dragging and dropping the available widgets. It is easy to set up or create an Interface by Blynk that controls our smart devices. Blynk is not associated with a specified hardware board or shield. We can connect our desired hardware without any complexity as shown in (Fig. 1).

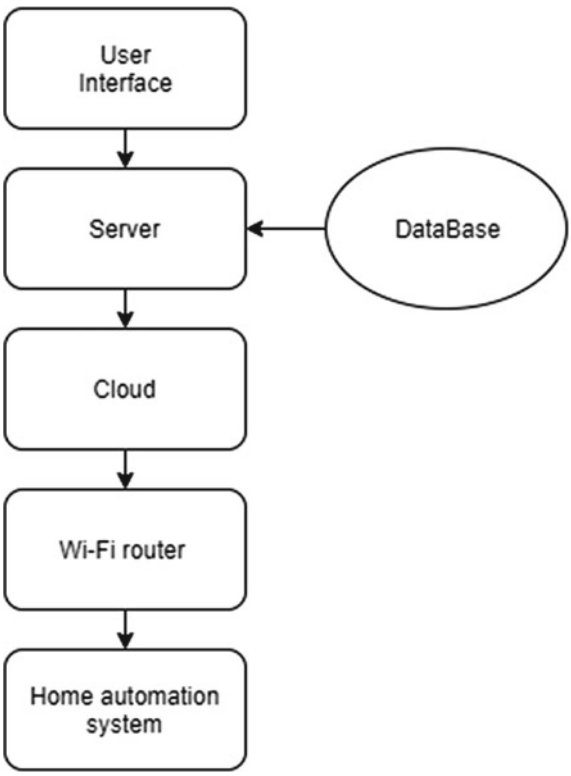


Fig. 1 Flow chart of Home Automation network architecture

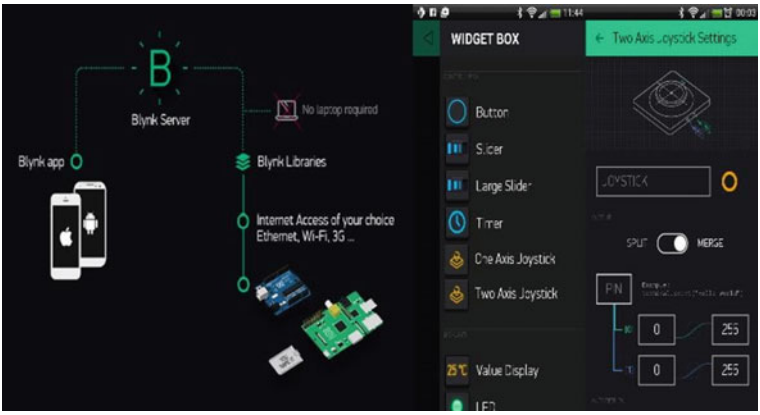


Fig. 2 Connection between Blynk server and application

Now visualize, each time you press a Button in the Blynk application, the message goes to the Blynk Cloud, where it mystically discovers its way to your equipment. It works equivalent the other way, and everything occurs in a blink of an eye. You can visualize it in (Fig. 2) [3].

IFTTT. IFTTT gets its name from the limited programming articulation "if this, then that." This open-source platform associates applications, gadgets, and services from various developers to trigger one or multiple automation, including those applications, gadgets, and services. The automation can be achieved through applets—which are similar to macros that associates various applications to run automated instructions. You can make an applet turn on or off utilizing IFTTT's site or mobile applications. You can likewise make your very own applets or make modifications of existing ones through IFTTT's easy to understand and smooth interface. IFTTT is simple to utilize. You have to download applications for Android or ios and sign up into a new account, and you're ready for action with automation in minutes.

There is a puzzling cluster of applets available, so IFTTT supportively gives automation proposals to new clients to attempt. Its Collection of bunches together applets for various platforms like iOS, Android, and voice assistants – and workout everything from applets for news and climate services to home automation. It is likewise conceivable to scan for particular applets or search under-classes, for example, business applications, connected vehicles, or health and fitness services. The "My Applets" screen gives clients a chance to oversee which applets are turned on at present and gives a history of those that have been utilized already. Clients can make their required applets by consolidating different application "services" and setting trigger parameters.

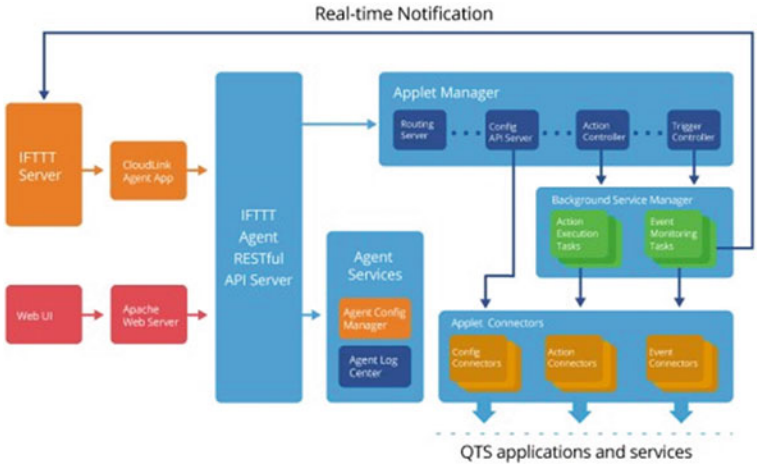


Fig. 3 IFTTT server architecture

Essential features of IFTTT:-

- Applet repository
- IF recipes (applets/services)
- Do recipes (applets/services)
- Guided custom recipe
- Analytics

Concerning clients, IFTTT presents them with an enormous archive of applets and services running from the imperative to the trivial. From climate to education, social media notifications to health alerts, the applets and services run the array of applications and smart appliances that can be connected. For instance, an applet can make Alexa call an appliance with the IFTTT integrated. Another case is to spare IOS contacts to your Google contacts. You can visualize IFTTT architecture in (Fig. 3).

3.2 Hardware Design

Arduino. At the point of discussing the Internet of Things, there is an essential association of specific innovations. So here, we will exhibit this fundamental structure blocks the Internet of Things. We have to have a decent web association which frames the critical component for information transfer. The Internet is a need so you can transfer the detected information from the hubs to the core center.

Microcontroller Unit (MCU) - ESP8266. ESP8266 is a simple micro-controller chip that acts as a wi-fi module to connect the IoT devices through the internet. To program esp8266, we need a microcontroller board like Arduino or FTDI converter

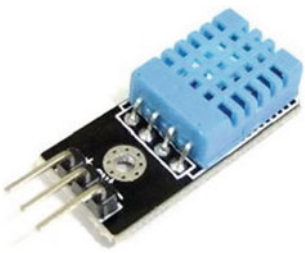
or USB to TTL converter. NodeMCU is an advanced version of esp8266, which comes with a microcontroller board and extra GPIO pins. It comprises of 64 KiB of programming RAM, and 96KiB of information RAM. It has up to 16 GPIO pins and provides SPI along with the I2C communication system. It is an ultra-low power-consuming hardware element with sufficient processing speed.

Sensors. *PIR Motion Sensor.* PIR motion sensor is a low-cost device that is commonly used to detect the presence of humans. They even consume less power. They are often used in home Automation in applications that involve the prevention of burglary and automation of lights based on the presence of humans. They are frequently alluded to as PIR, "Passive- Infrared," "IR-motion," or "Pyroelectric" sensors. PIR sensors are typically made of a pyroelectric sensor which can identify levels of infrared radiation. Every object produces some lowlevel radiation, and the hotter an object, the more radiation is transmitted. The sensor in a motion-detecting device has two halves. We have used Hc-sr501 PIR motion sensor in this project (Fig. 4).

Humidity and Temperature Sensor. In this project, we are using DHT11 as humidity and temperature sensor. It contains a capacitive humidity sensor and a Thermistor. It has an inbuilt 8-bit microcontroller. Most moisture sensors use capacitive measurements to decide the measure of humidity noticeable in the air. DHT11 sensors have an extremely accurate humidity calibration chamber. It is small, consumes less power, and has a signal transmitting range of 20meters. Because of its features, it can be used in many applications, even the most critical ones. It is a single row package with 4 pins. It can be interfaced easily and based on the applications special packages were used. DHT11 Temperature and Humidity sensor module (Fig. 5).

Fig. 4 PIR Sensor

Fig. 5 DHT11 Sensor



4 Results and Discussion

To execute our home automation network, we have to prepare an experimental setup, as appeared in Fig. 6. We use a PIR motion sensor, which on recognizing the absence of people for a particular time, turns off the device. It can also be used to notify the user when an intruder arrives at the door for security purposes. We can control the intensity of led bulbs, mood lights, and speed of the fan by using the slider widget, and we can monitor the readings of Temperature and humidity sensor through Gauge or History graph widgets in Blynk application. We can access our IoT through voice commands by creating applets in IFTTT web service through our google account. We have implemented our home automation setup on our experimental arrangement, which worked effectively with no error and is shown in Fig. 6.

The proposed model of the framework was structured for the minor project of our college. Four different isolated sub-systems in our project are:

i. To control the Relay circuit associated with smart devices.
ii. Temperature and Humidity sensor associated framework.
iii. PIR sensor for movement detection.
iv. IFTTT to provide voice access services.

These were connected through Wi-Fi utilizing the NodeMcu controller chip. The present and past information of temperature and humidity can be acquired from anyplace utilizing the Blynk application. Further, this framework can be utilized in

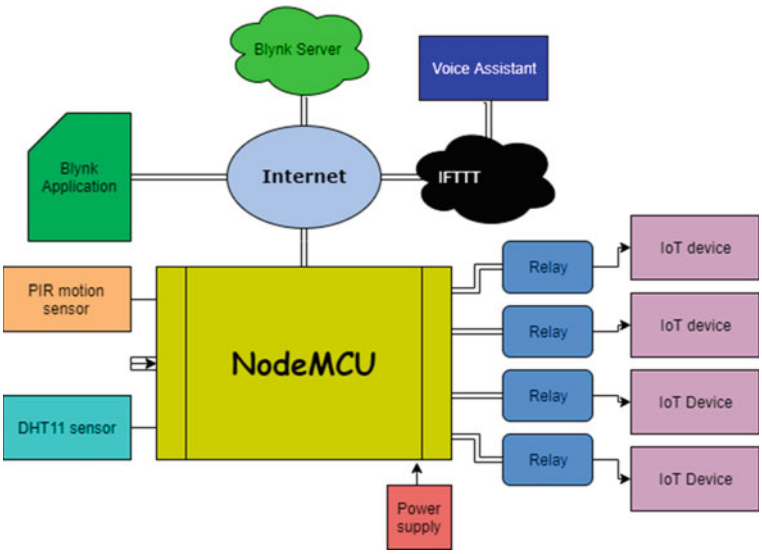


Fig. 6 Block Diagram of proposed model

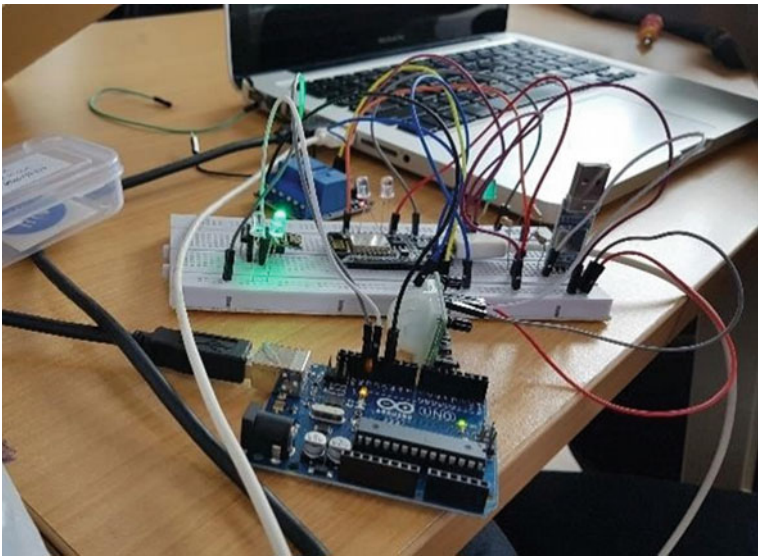


Fig. 7 Hardware design of proposed model

numerous spots like banks, houses, nursery, roads, private lofts, clinics, traffic stations, poultry ranches, research centers, and so forth. This framework can be utilized in various fields and territories to cause them to work adroitly. Our experimental demonstration is shown in Fig. 7.

5 Conclusion

In this paper, we have presented a home administration and security framework. This paper is primarily centered on implementing a simple, smart home where one can operate their appliances remotely, schedule their cellar and balcony lights, control the intensity of mood lights, operating appliances through voice, analyzing room temperature and moisture content, and intrusion detection. It can also be used in the garden alongside drip irrigation, which saves many resources like energy, water, time, so on. Our prototypical framework is appropriate to home security, mechanization, observing, and controlling of remote frameworks. The future works include connecting our IoT module with daily life smart devices like fit bands or smart-watches, mobiles, and various sensors. All these devices are connected to a centralized hub that can make decisions on its own by analyzing user stress levels, surrounding temperatures, and various others. These decisions operate our connected IoT devices without human or application intercession. By implementing such a prototype, we can further advance the IoT implementation.

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