

# IOT Based Home Automation

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## Abstract

By the virtue of blooming automation industry and wireless connectivity, all the devices within the home can be connected. Today's World is moving to digitalization where everything is made easy and comfortable for people i.e. Young youth as well as senior citizen. Smart Automated House Application using IOT (Internet of Thing) is a system where basic house facility can be handled by device from any place such as ON and Off of Light, Fan, TV, washing machine & etc. One can handle all this things with help of device ESP8266, Android Blynk Application, Internet Connection. This paper include functionality of node EP8266 are connected with either of above given house application like fan, light, water pump, gardening with help of coding and hosting online with web server. All the functionality is handled by Mobile App created in android application, from which house application are controlled with help of internet. This paper is clarifying that monitoring of circuit devices through wireless using Node MCU and controlling using App Blynk. According to requirement of need one can connect multiple device like sensors, appliance and many more till. [1]

**Keywords:** Wireless Control, Internet of Things (IoT), Home Automation, ESP8266, Blynk, Mobile App.

## 1. INTRODUCTION

IoT (internet of things) in recent years have become lifestyle of human being with great potential [1]. Even it is focusing on different task that are requirement of human intelligence. In today's scenario IoT has opened doors to that cover up all requirements of human dealings in their daily life. Example like purchasing of goods, monitoring of resources and remotely control them from any corner of the world. Think about a world were personal refrigerator will provide you list of all your stuff required for upcoming few days base on your present utilization in it. Even envisage your fridge is interactive with Home automation refers to remotely monitoring the conditions of home and performing the required actuation. Through home automation, household devices such as TV, light bulb, fan, etc. are assigned a unique address and are connected through a common home gateway. These can be remotely accessed and controlled from any PC, mobile or laptop. That can drastically decrease energy consumption and get better the living environment as well as enhancing the indoor safety. Along with the quick developments in technology, the devices in the recent past are becoming smarter. The real world appliances are being prepared with intellect and computing capability so that they can configure themselves accordingly. Sensors attached to embedded devices along with the low power wireless connectivity can facilitate to remotely monitor and control the devices. This forms an integral component of Internet of Things (IoT) network. IoT also helps in transferring of data from sensors through wireless network, achieving recognition and informational exchange in open computing network. Things that we are using in our

daily life are becoming smart with the current technologies but it isn't sufficient until we connect them to act with the dynamic environment and in addition to make their own inter-network, that is, machine-to-machine communication. The Objects like electronics devices, software's, sensors, actuators, home appliances and vehicles are connected to a wireless network. Internet of Things is considered as a wireless network of these objects and they can exchange data through light weight protocols like MQTT, CoAP etc. There are so many types of radio modules out of which GSM, 3G, WiFi, Bluetooth, ZigBee, etc. are common. However, owing to the surging number of hotspots and range sufficient to perform the required control and monitoring, WiFi is chosen as the mode of communication in the prototype and the devices are controlled through Blynk App implemented using ESP8266 .

## 2. LITERATURE REVIEW

Smart cities based on IoT[3] technology are becoming more and more popular. Initial goal of IoT was to connect physical devices to internet. Then, Web of Things (WoT) become prominent to easily connect sensors to the web, get the data to and from the web that has been created by the devices. The READY4 Smart Cities aims at dropping energy utilization and CO2 emission in the cities making use of ontologies and associated data. The project is actually intended to produce and supply energy-related data such as climatic, pollution, traffic, activity etc. But it doesn't encompass vital IoT domains like healthcare, smart farm etc. and neither does it mention need to incorporate a reasoning engine to analyze IoT data. The STAR-CITY project is deployed in four cities: Dublin, Bologna, Miami and Rio. They use semantic web technologies to identify and forecast road traffic Jams. As per the design, they have used six heterogeneous sources: road weather conditions, weather information, Dublin bus stream, social media feeds, road works and maintenance, and city events. They use Semantic Web Rule Language (SWRL) rules such as heavy traffic flow. The project is mainly focused on the traffic investigation. The City Pulse project is intended for public parking space availability calculation, real time travel planner, air pollution counter-measures, and opting efficient routes and public transfer . The project is aimed on large-scale analysis and realtime processing. The Smart Santander project deployed 20,000 sensors measuring hotness, moisture, particles, CO and NO2 for monitoring parks and gardens irrigation, outdoor parking is organization, traffic intensity monitoring, and smart metering.

**My research work:-** The main objective of this research work is to review the existing research work on smart home system sand discover the approaches adapted, the hardware and networking technologies utilized, and the security systems considered. The four previously mention question are linked to these objectives. The concept of "Home Automation" has been in existence for several years. "Smart Home", "Intelligent Home" are terms that followed and is been used to introduce the concept of networking appliance within the house. Home Automation Systems (HASs) includes centralized control and distance status monitoring of lighting, security system, and other appliances and systems within a house. HASs enables energy efficiency, improves the security systems, and certainly the comfort and ease of users.

## 3. OBJECTIVE

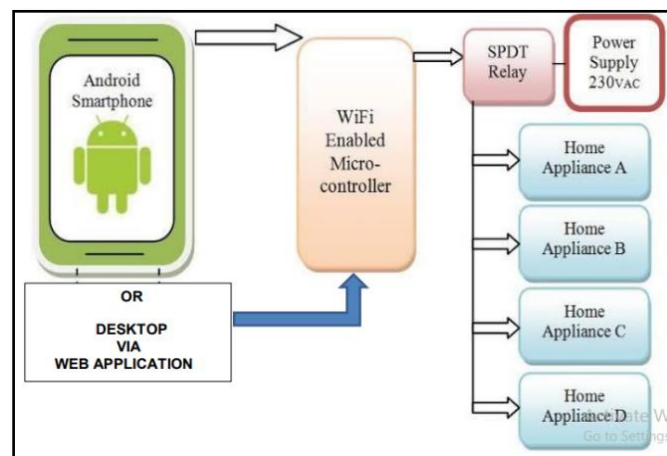
A major objective of this paper was to help elderly handicapped people by controlling various home appliances and provide security using Android phone/tablet. So, the solution is designed for an Android phone upon a home automation system which uses Arduino Mega ADK and embedded devices/sensors. The proposed system has a great flexibility based on Wi-Fi technology used to interconnect and control

a part of the modules (the relay, LEDs) and its distributed sensors (motion sensor) to HAS server, all being developed around Node MCU.

The objective of work is to design a prototype that establishes wireless remote control over a network of home appliances. The application is designed to run on android device providing features like, switch mode control, voice command control and a provision to view the status of the devices on the application itself. Considering its wide range of application, following are the scope of this prototype. The system can be implemented in homes, small offices and malls as well, being in-charge of control of the electrical appliances.

#### 4. PROPOSED SYSTEM

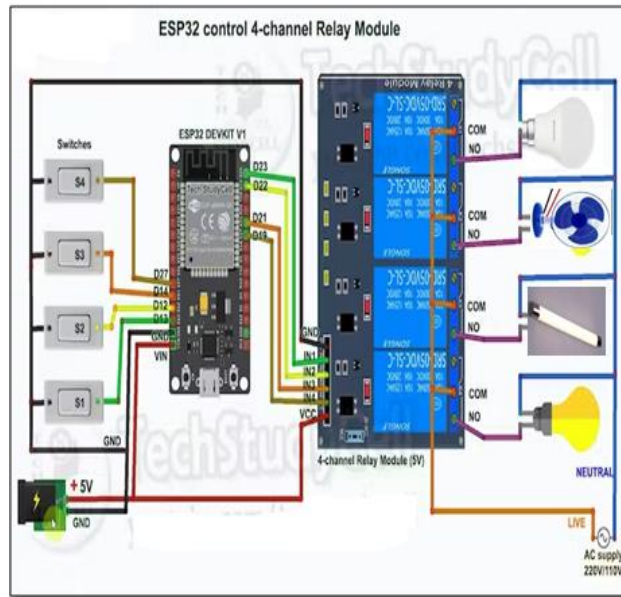
Real Time clock based home automation in an advance project to control the devices in timely and systematic manner. The devices can be controlled through wireless from other places. Technologies of NODE MCU with IP Address are used for working of the devices or appliances. Basically the project is a concept to bring automation in the home or industry. All the home appliances will be controlled by IP Address. The appliances in the industry or home will be interfaced with centralized micro controller NODE MCU for the systematic working.



**Fig 1. Block Diagram of System**

#### 5. SYSTEM IMPLEMENTATION

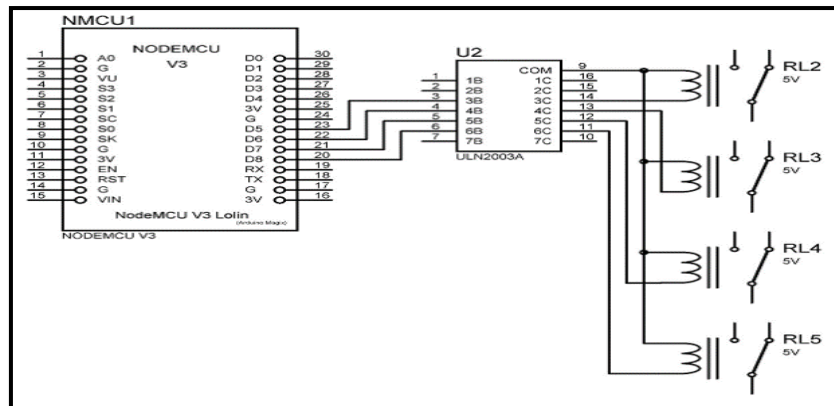
The system is divided into two major parts: software and hardware design. Hardware configuration involves arranging microprocessor, microcontroller, sensors and actuators whereas software portion encloses programming that is written and uploaded in each of the microcontrollers and microprocessor. The system consists of microcontroller connected to sensors and electrical devices that are to be monitored and controlled. This section shows how different hardware components are set up. The specifications and information regarding various components used in this system are descriptively explicated below. The main aim of Smart Home is useful in order to provide better energy utilization, efficiency, comfort and to provide better true security. Nowadays Smart Home automation is more used in India because of the cost and the easily getting devices. Also, devices for the automation are easily available. The main objective here is to present a Small IOT system designed and created by utilizing WLAN network based on ESP8266. The System is able to control home electronics devices by the mobile phone via internet. Results from test of the system show proper control and monitoring functions can be performed from a device linked to a network.



**Fig 2. System Implementation**

**A. CIRCUIT DIAGRAM**

Using components and materials mentioned above. Figure below shows the project that’s used as an (IoT) system controlled by Web application. Loads used in this project are bulbs, they can be changed with other devices by changing bulbs with AC plugs to connect home use devices or equipment.



**Fig.3.Circuit Diagram**

To make the connections easy to follow, here is a pin map of the connection between the NODE MCU and the Relay Module:

No Node MCU – Relay Module

- 3.3V - VCC
- GND - GND
- D1 - IN1
- D2 - IN2
- D5 - IN3
- D6 - IN4

In the above figures, 4-Channel Relay module is interfaced with the Node MCU and Four AC power loads are connected to the Relay i.e at IN1, IN2, IN3,IN4. User can operate this loads using GUI/Web

Server. Appliances can be turned ON/OFF by sending On/OFF commands from the web application. The processor then controls the switches based on the commands received from the user and also updates the user about the status of the switches after the control operation is performed to the cloud.

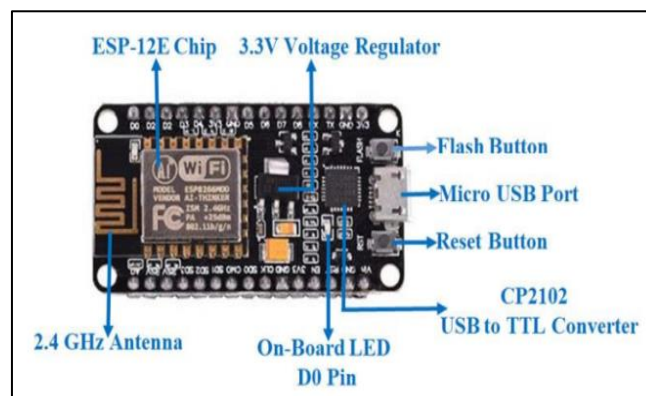
**B. HARDWARE USED IN PROJECT**

In this project some hardware components have been used to control the home appliances. Such as:

1. Node MCU (ESP8266-12E)
2. Blynk application
3. 4-Channel Relay Module
4. Switch
5. 5 V 1Amp AC To DC Adapter
6. Jumper wires
7. Mobile devices and Electrical Appliances

**6. NODE MCU (ESP8266-12E)**

The heart of project is the Wi-Fi enabled board that needs no introduction; the ESP8266 based Node MCU development board. Node MCU is an open-source based software and development board specially targeted for Iota based Applications. It includes firmware that runs on the ESP8266 hotspot from Node mcu Systems, and hardware which is predicated on the ESP-12 module. Node MCU was born out of the desire to overcome the limitations associated with the first versions of the ESP8266 module which was not compatible with the breadboards; it was difficult to power and had more difficulty in programming. The Node MCU board is easy to use at a very low cost and that quickly endeared it to the heart of makers and it is one of the most popular boards today. Both the firmware and prototyping board designs are open source. The firmware uses the scripting language. The firmware is predicated on the Eula project, and built on the espresso Non-OS SDK for ESP8266. It uses many open source projects, like lua-cjson and SPIFFS. Thanks to resource constraints, users got to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented. The prototyping hardware generally used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allowed a easier way of prototyping on breadboards. The design was initially supported on the ESP-12 module of the ESP8266, which may be a Wi-Fi integrated with a Ten silica Xtensa LX106 core, that is widely utilized in IoT applications.



**Fig.4. NODE MCU**

The sole reason for using the Node MCU over Raspberry Pi is that the Node MCU has inbuilt Wi-Fi. This reduces the cost and hence the Node MCU is cheaper than the other devices available in the market. Inbuilt Wi-Fi helps in remote access. The system is accessible from any remote location round the world provided an online connection. Once given an input, the device will still operate albeit there's no internet access. The device can be physically handled as well.

### 1. BLYNK APPLICATION

The Blynk application was designed for the primary purpose of Internet of Things.

**Blynk** is a platform with IOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet.

**Blynk Application:** allows to you create amazing interfaces for your projects using various widgets we provide.

**Blynk Server:** responsible for all the communications between the smartphone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. It's an open source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.

**Blynk Libraries:** for all the popular hardware platforms – enable communication with the server and process all the incoming and outgoing commands.

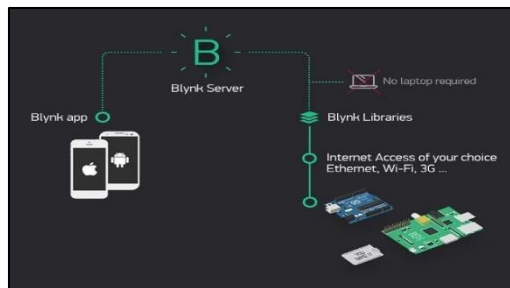


Fig.5. Blynk Application

### 2. FOUR CHANNEL RELAY MODULE

The relay is those devices that open or closes the contacts to cause the operation of the opposite electric control. It detects the intolerable or unwanted condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area. Thus isolates the system from damage. The 4 Channel Relay Module may be a convenient board which may be used to control high voltage, high current load like motor, solenoid valves, lamps and AC load.

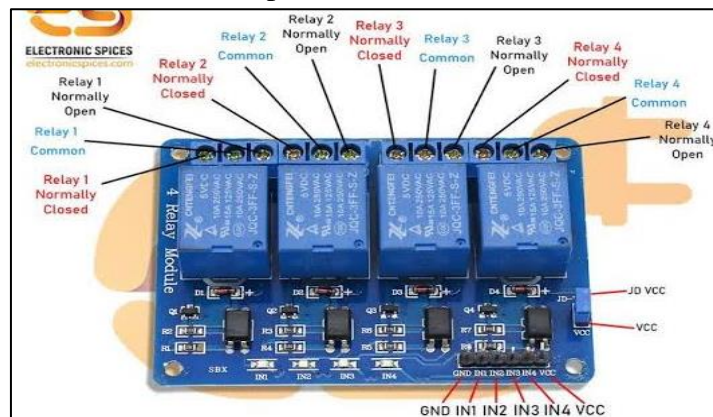


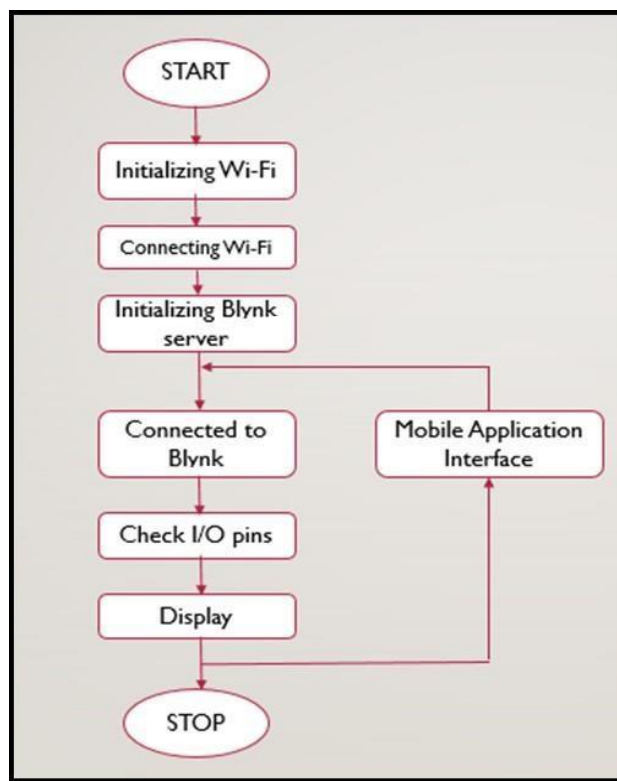
Fig.6. Four Channel relay module

### 5. EXPERIMENTS CONDUCTED

After giving the 5Volt DC supply and AC supply to the NODE MCU. Then NODE MCU started and then input is given to the relay. Hotspot of mobile is connected to the NODE MCU. Following results were obtained as tabulated 2.0 below at different distances.

Device	Distance in Kilo Meter	Appliances Images	Rating	20	42	55	68	75	120	135	155	
Tube Light	Working		18 Watt	✓	✓	✓	✓	✓	✓	✓	✓	
	Not working											
	Delay in sec			1	1	1	1	1	1	3		
Fan	Working		65 watt	✓	✓	✓	✓	✓	✓	✓	✓	
	Not working											
	Delay in sec			1	1	1	1	2	2	2	3	
TV	Working		30 watt	✓	✓	✓	✓	✓	✓	✓	✓	
	Not working											
	Delay in sec			1	1	3	3	3	3	4	3	
Home Theater	Working		34 Watt	✓	✓	✓	✓	✓	✓	✓	✓	
	Not working											
	Delay in sec			1	1	1	2	3	3	3	3	3
Geyser	Working		1500 kw	✓	✓	✓	✓	✓	✓	✓	✓	
	Not working											
	Delay in sec			1	3	3	4	4	4	4	4	4

**Table.1 Home Appliances Matrix**



**Fig.7. Flow chart**

In the flowchart (Flowchart 1) the program will send data in the form of digital output from the RCWL 0516 module through the ESP8266 module. Software specifications used, as follows: a. The Arduino microcontroller program uses Arduino language with a number of related libraries, such as ESP8266 and Blynk Library. b. The program on smartphones uses applications available to control devices via the internet.

IOT software addresses its key areas of networking and action through platforms, embedded systems, partner systems, and middleware. These individual and master applications are responsible for data

collection, device integration, real-time analytics, and application and process extension within the IOT network. They exploit integration with critical business systems (e.g., ordering systems, robotics, scheduling, and more) in the execution of related tasks.

## 6. RESULTS

The Light Control Test is done by pressing the ON / OFF button widget on the Web application on the respective Android smart phone/Pc for lights and fans. This is done after the system is turned on and connected to a Wi-Fi internet connection. If at any time the internet connection is lost or bad signal, then it also affects system performance.

Sr. No	Case	Blynk app Screen	Load Appliances
1	OFF Condition		
2	1 Relay ON		
3	2 Relay ON		

**Fig.8. Blynk Application and Load**

## 7. CONCLUSION

Based on the results of analysis of all data obtained by testing the smart home with the Internet of Things based Node MCU ESP6288 module, the following conclusions can be drawn: 1) Smart Home with Internet of Things (IoT) based Node MCU ESP8266 Module can be designed with various components hardware and software support so that it can be arranged into a smart home system that is controlled with the Web application according to what is intended. 2) The Smart Home with this Internet of Things (Iota) based Node MCU ESP8266 Module can be implemented to control some of the home electronics performance including lighting controls, fan control, temperature monitoring, early warning systems and etc. 3) Main purpose of home automation system is to provide ease to people to control different home appliances with the help of the web application using their mobile phones or desktop and to save time and money.

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