Home Automation using ESP-32 and Android App

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Abstract*: The Home Automation System (HAS) is extension of current activities performed inside the home and this Home Automation System can be developed easily now a days, because of powerful computational devices and wireless sensor network(WSN), to IoT-Based Smart Bank to Achieve Home Automation with Gesture Detection and Control. The main objective of this project is to develop a home automation system using an ESP8266 board being remotely controlled by any Android OS smartphone. Modern houses are gradually shifting from conventional switches to centralized control systems, involving remote controlled switches. Ever thought of a life where you could just command your home appliances to work as you need just by using your voice. Coming days we are going to use automated houses which are activated. This project will demonstrate, controlling home electronic appliances like T. V. , fans, lights etc., using the internet and your voice and that too low budget. The Home Automation System (HAS) is extension of current activities performed inside the home and this Home Automation System can be developed easily now a days, because of powerful computational devices and wireless sensor network(WSN), to IoT-Based Smart Bank to Achieve Home Automation with Gesture Detection and Control. The main objective of this project is to develop a home automation system using an ESP8266 board being remotely controlled by any Android OS smartphone. Modern houses are gradually shifting from conventional switches to centralized control systems, involving remote controlled switches.*

Ever thought of a life where you could just command your home appliances to work as you need just by using your voice. Coming days we are going to use automated houses which are activated. This project will demonstrate, controlling home electronic appliances like T. V. , fans, lights etc., using the internet and your voice and that too low budget

Keywords: *Home Automation System*

I. INTRODUCTION

The main objective of this project is to develop a home automation system using an Arduino board with Bluetooth being remotely controlled by any Android OS smartphone....Modern houses are gradually shifting from conventional switches to centralized controlsystem,involving remote controlled switches.

Ever thought of a life where you could just command your home appliances to work as you need just by using your voice?Gone are the days where you have to be a billionaire like TonyStark to have an automated house which is voice activated.In this short tutorial I'm going to show you how you can control your electronic appliances like T.V,fans,light set cover the internet with your voice and that to under a low budget.You can follow this tutorial even if you have no prior knowledge about Programming or NodeMCU.So lets begin learning HomeAutomation Using NodeMCU and GoogleAssistant Home automation is anything that enables you to use your home's lighting, heating and appliances more conveniently and efficiently. It can be as simple as remote or automatic control of a few lights, or it can be a complete system that controls all major parts of your home. Custom set to your own personal preference.

It focuses on wireless home automation technologies - these are easy to retrofit into existing homes now need for new wiring and no ripping up the carpets or drilling holes in the walls.

Each technology has its own unique features and benefits that makes some more suited to particular applications, whilst others can be seen for all general home automation installations.

Components required:
- Bread board

- ESP8266
- Relay
- Connecting wires
- DC fan
- LED
- Mobile phone with Google assistant
- Blynk app
- Arduino IDE
- Wi-Fi router or mobile Hotpost
- IFTTT web application

About components and requirements:

Bread board is a construction base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used for slicing bread. In 1970s the solderless breadboard because available and now a days the term "breadboard" is commonly used to refer to these.

Because the solderless breadboard does not require soldering, it is reusable. This It easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education. Older breadboard types did not have this property. A stripboard and similar prototyping printed circuit boards, which are used to build semi-permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronics systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units.
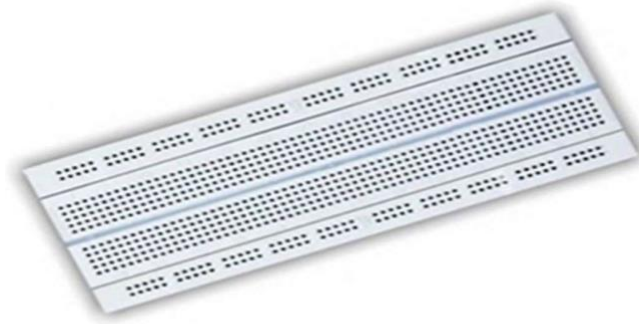

ESP8266 board is a low cost Wi-Fi module, is a self contained System-On-Chip with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

The chip first came to the attention of Western makers in August 2014 with the ESP01 module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontroller to connect to a Wi-Fi network and make simple TCP/IP connections using Hayesstyle commands. However, at first there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, the chip, and the software on it, as well as to translate the Chinese documentation.

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Relay is an electrically operated switch. It consists of a set of input terminals for a signal or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts or multiple contact forms, such as make contacts, break contacts, or combinations thereof.

Relay are used where it is necessary to control a circuit by an independent lowpower signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.
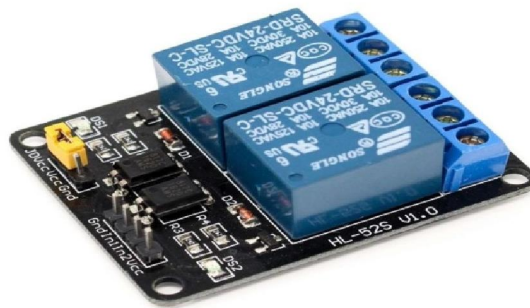

 DC fan are powered with a potential of fixed value such as the voltage of a battery, it is used for cooling motors and transmissions, for cooling and drying people, also used in cooling of IC in C. P. U.

Google assistant is an artificial intelligence-power virtual assistant developed by Google that is primarily available on mobile and smart home devices. Google assistants can engage in two-way conversations. Actions on Google allows 3rd party developers to build apps for google assistant. Letting third-party device makers incorporate their own "Actions on Google" commands for their respective products.

Incorporating text-based interactions and more languages. Allowing users to set a precise geographic location for the device to enable improved location-specification queries.

Google Assistant, in the nature and manner of Google now, can search the Internet, schedule events and alarms, adjust hardware settings on the user's device, and show information from the user's Google account. Unlike Google Now, however, the Assistant can engage in a two-way conversation, using Google's natural language processing algorithm
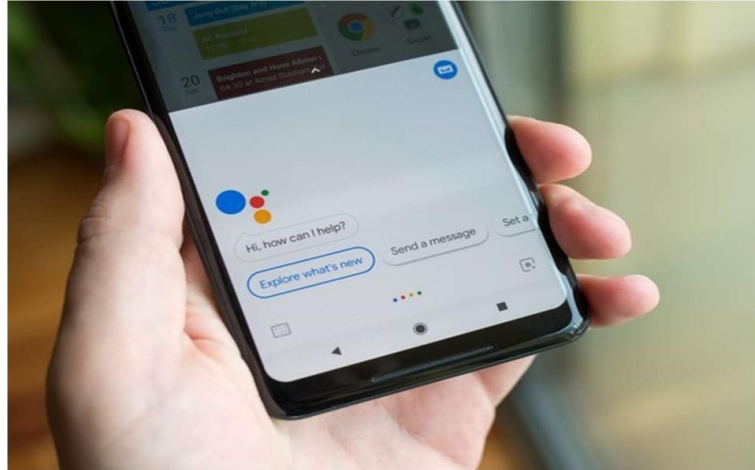
IFTTT is a freeware web-based service that creates chain of simple conditional statements called applet is triggered by changes that occur within other web services such as Gmail etc. For example, an applet may send an e-mail message if the user tweets using a hashtag, or copy a photo on Facebook to a user's archive if someone tags a user in a photo. In addition to the web-based application, the service runs on iOS and Android. Triggers are the "this" part of an applet. They are the items that trigger the action. For example, from an RSS feed, you can receive a notification based on a keyword or phrase. Actions are the "that" part of an applet. They are the output that results from the input of the trigger. Applets (formerly known as recipes) are the predicates made from Triggers and Actions. For example, if you like a picture on Instagram (trigger), an IFTTT app can send the photo to your Dropbox account (action).[21]

Ingredients are basic data available from a trigger—from the email trigger, for example; subject, body, attachment, received date, and sender's address

Blynk is a platform with IOS and Android apps to control Arduino, Raspberry Pi and likes over the internet. It's a digital dashboard where you can build a graphics interface for your project by simply dragging and dropping widgets.
Blynk works over the Internet. This means that the hardware you choose should be able to connect to the internet. Some of the boards, like Arduino Uno will need an Ethernet or Wi-Fi Shield to communicate, others are already Internetenabled: like the ESP8266, Raspberri Pi with WiFi dongle, Particle Photon or SparkFun Blynk Board. But even if you don't have a shield, you can connect it over USB to your laptop or desktop (it's a bit more complicated for newbies, but we got you covered). What's cool, is that the list of hardware that works with Blynk is huge and will keep on growing. The Blynk App is a well designed interface builder. It works on both iOS and Android, so no holywars here, OK?

Arduino IDE(Integrated Development Environment) is a cross-platform application that is written in functions from C and C++. It is used to write and upload programs to Arduino Compatible boards, but also, with the help of 3rd party cores, other vendor development boards.


Connecting wires, allows an electrical current or signal to travel from one point on a circuit to another because signal or current needs a medium through which to move. In basic circuits, the wire comes from one terminal of a power source, such as a battery.

WiFi hotspot is simply an area with an accessible wireless network. The term is most often used to refer to wireless networks in public areas like airports and coffee shops. Users can even create their own mobile hotspot using a cell phone or an external device that can connect to a cellular network.

II. CIRCUIT DIAGRAM
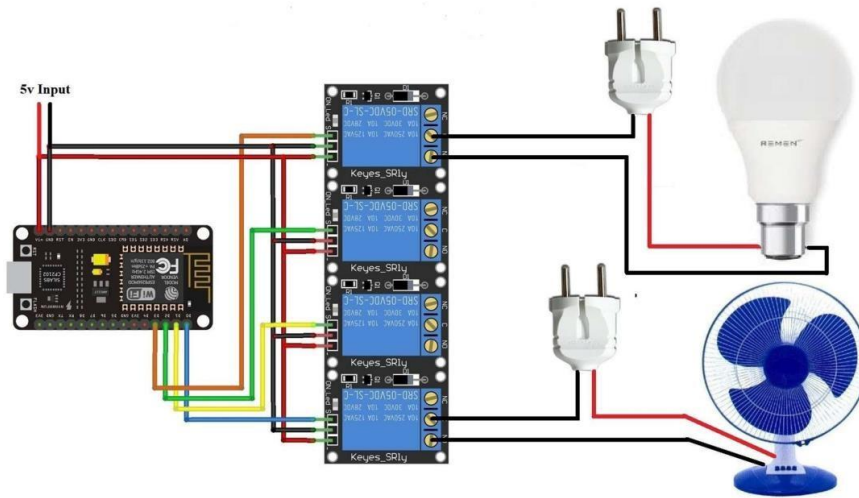
The Home automation is operating with Nodemcu esp8266 controller and the command is given by the Blynk android application in a mobile phone using the wifi network. The Nodemcu esp8266 as inbuilt wi-fi module and the devices connected with Home automation. Both wi-fi is connected with an authentication token .For demonstration in this project DC appliance and power supply are used, NodeMCU Vin and Ground were given to voltage supply either micro USB also power supply will be given. Digital Pins D0, D1 are connected to relay IN1, IN2 respectively and VCC and Ground of relays connected parallel to Vin and ground.

For appliances connection will connected to output pins holder of relays.

A home automation system is an automating the bulk of electronic and electrical tasks with in a home.It uses a combination of hardware and software to enable control and management over appliances and devices within a home.Home automation not only refers to reduce human efforts but also energy efficiency and time saving.Here we are performing home automation by using ESP8266–WiFiSoC and Blynk PlaystoreApp.

Code

```
 #define  BLYNK_PRINT  Serial  #include  <ESP8266WiFi. h>  char  auth  [  ]  =  "tJkoRhpp51-
4MEVRUAng6vEC7J4ia0W9"; // auth token from Blynk app.
char ssid[ ] = "Your network name"; char pass[ ] = "Your network password"; void setup( )
{
        Serial. begin(9600); digitalWrite(D0, HIGH); digitalWrite(D1,
HIGH);
        Blynk.begin(auth, ssid, pass);
} void loop(
)
{
        Blynk.run ( );
}
```

Procedure to make coding to ESP8266

Open Arduino IDE.

Click on Sketch, select include library and select Manage libraries.

Users can see the dialog box, search blynk in the search bar.

Click on Install.

It took a few minutes depending on the user's data speed.

Click on File, select preferences paste this link given below in Additional Boards Manager URLs.

http://arduino.esp8266.com/stable/package_esp8266com_index.json

Click on OK.

Click on tools, select board managers, search nodemcu in the search bar.

Click on install.

Click on files, select examples, select Blynk, select board WiFi, select ESP8266_Standalone.

Users can get code for ESP8266_standalone. Just few will edit i.e., auth token, network name, network password.

These two syntax play a major role while operating appliances, whenever WiFi connected to NodeMCU with power supply they get automatically operated, to reduce this drawback this syntax will help.

Syntax: digitalWrite (pin no. , HIGH);

According to your requirement of appliances, users have to include them in programming NodeMCU.

Procedure to make automation via Blynk, Google assistant

Here there are two way to control our appliances those are through Blynk, Google assistant

Through Blynk

First install Blynk app in a mobile phone i.e., Android or iPhone.

Then the user logs in with their respective mail ID.

Users receive a token in mail which they need for programming.

Furtherly the user receives an auth token for Blynk this place a major role.

Add a new project named as Home automation.

Arrange button according to user requirement.

Select board, edit pin number.

Up to here setup of blynk ready.

Copy and paste auth token in ESP8266 in Arduino IDE.

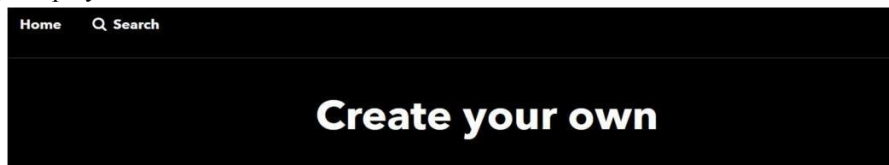Up to here automation can control through mobile phones.

Through Google assistant

For Google assistant service, IFTTT web application will help.

Users have to create an account, which they can use for their Google assistant.

Click on explore, select create applet.

Then the web page displays if this then that.

Click on If This, type Google assistant in search of that web page search bar, simply choose your service.

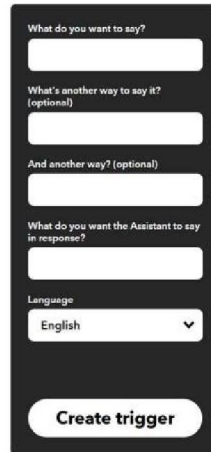Click on say a simple phrase.

Fill the space accordingly to what they are asking.

Example: turn on light, for this google assistant can replay OK, turning on light.

Click on create trigger.

Click on Then That, choose webhooks services.

On selecting webhook services, click on make a web request.

Fill the space according to the images. For URL, blynk server required in command prompt (CMD) type this command below

>> ping blynk-cloud.com

The required IP address: 188.166.206.43

http://188.166.206.43/AuthTokenThatYouReceived/update/PinNumberNodeMCU

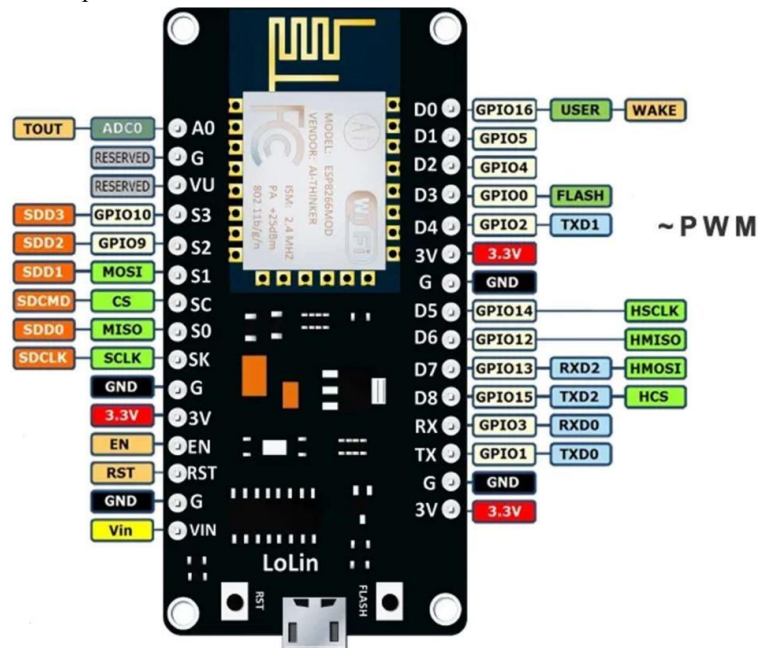Example:http://188.166.206.43/abcd123483A/update/D1

Check out the pin diagram of NodeMCU with respect to Arduino.

Example: If D0 then D16

Body is used to give signal i.e., ON and OFF for ON - ["0"], for OFF["1"] ● Click on create action, and end with finish.

Pin diagram of NodeMCU with respective to Arduino Uno

Here D0, D1…. are digital pins of NodeMCU next to that GPIO16, GPIO5….are arduino pins i.e., they are actual pins to update in URL link in webhooks. Users have to observe this diagram.

NodeMCU provides access to the GPIO (General Purpose Input/Output) and a pin mapping table is part of the API documentation.

I/O index	ESP8266 pin
0	GPIO16
1	GPIO5
2	GPIO4
3	GPIO0
4	GPIO2
5	GPIO14
6	GPIO12
7	GPIO13
8	GPIO15
9	GPIO3
10	GPIO1
11	GPIO9
12	GPIO10

IV. WORKING

The Home Automation System is operating with NodeMCU ESP8266 controller and the command is given by the Blynk application in a mobile phone using the WiFi network. The NodeMCU ESP8266 has an inbuilt WiFi module and the devices connected with Home Automation System. Both WiFi is connected with an authentication token.

The heart of today's project is the WiFi enabled board that needs no introduction to the ESP8266 based NodeMCU_development board. It is an open source platform for developing WiFi based embedded systems and it is based on the popular ESP8266 WiFi module, running the NodeMCU firmware. NodeMCU was born out of the desire to overcome the limitations associated with the first versions of the ESP8266 module which was not compatible with breadboards. It was difficult to power and even more difficult to program. The NodeMCU board is easy to use. Low cost and that quickly endeared it to the heart of makers and it is one of the most popular boards today. For this project two channel relay modules are added to the ESP8266 board. The project flow involves the control of NodeMCU's GPIO from a webpage on any device connected on the same network as the board. The status of the GPIO's control the coil of the relays and causes the relay to alternate between normally open(NO) and normally close(NC) condition depending on the state of the GPIO, thus effectively turning the connected appliance " ON" or " OFF".

Now the operation is gone by giving supply either Micro USB or Vin, GND. It can operate by Blynk application in mobile phone i.e., Android or iPhone by manual and via Google Assistant with voice. The Hardware is well operated according to our action.

Applications
- Lighting control
- Lawn/Gardening management
- Smart home appliances
- Improved home safety and security
- Home air quality and water quality monitoring
- Better infotainment delivery
- Most preferable language based voice assistant

Advantages
- It can operate anywhere through the world.
- Security against burglars.
- It is available at low cost.
- Voice control home function.
- Managing all of your home devices from one place.
- The convenience factor here is enormous.
- Flexibility for new devices and appliances.
- Maximizing home security.
- Remote control of home functions.
- Increased energy efficiency.
- Improved appliance functionality.
- Home management insight.
- Reduce human efforts: As this system works automatically humans do not require to apply more efforts.
- Multitasking: Multiple functions are done at the same time without the efforts of the human.
- Reduce time: As this system is multitasking so the time required will be less.

Disadvantages
- Due to improper network connection may lead to failure of working.
- Those who don't afford WiFi connection bills, they can't buy these products.

- Cost, The disadvantage of a smart home system or Home automation system is the cost. There are quite a number or companies that provide smart home systems, but all of them are quite expensive. This also might be expensive.
- Dependency on the internet, the basic requirement for the smart home system is the internet.

V. FUTURE SCOPE

Using this system as a framework. The system can be expanded to include various other options which could include home security features like capturing the photo of a person moving around the house and storing it onto the cloud. This will reduce the data storage that using the CCTV camera which will record all the time and stores it. The system can be expanded for energy monitoring or weather stations. This kind of a system with respective changes can be implemented in the hospitals for disable people or in industries where human invasion is impossible or dangerous and it can also be implemented for environmental monitoring.

Future scope for the home automation systems involves making homes even smarter. Homes can be interfaced with sensors including motion sensors, light sensors and temperature sensors and provide automated toggling of devices based on conditions.

Home automation offers a global standard for interoperable products.

The home automation market is primarily driven by growing need for effective solutions in various domestic applications such as lighting, safety and security, energy management, entertainment, heating, ventilation, and air conditioning.

VI. 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 sensor but also actuates a process according to the requirement. For example, the switch 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 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. Home automation is undeniably a resource which can make a home environment automated. People can control their electrical devices via these home automation devices and set up controlling actions through mobile. In future this product may have high potential for marketing. Further it can be demonstrated from computer instead of mobile phones for controlling appliances of any large places like industries, hospitals, institutions etc., centrally.