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# DEVELOPMENT OF HOME AUTOMATION SYSTEMSBY USING ANDROID APPS

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**ABSTRACT**

The purpose of this paper is to develop an android based home automation systems using raspberry pi. This project focuses on the smart home electrical appliances such as light and fans so that they can be controlled from far or mobile communication systems that is using 3G network. Status of the fan or light whether it is off or on is collected by the Raspberry Pi as the main processor. The access point will transmit data using internet. The data is accessed by using smart phone operating in Android application. This technology offers new and exciting opportunities to increase the connectivity of devices within the home for purpose of smart home controller, due to their portability and their wide range of capabilities. They can communicate with a smart home controller network through an internet gateway. This project creates a user friendly interface for the android devices that allow a user to communicate with the Raspberry Pi server and the server is communicating with the corresponding relay. Each relay is connected to electrical appliances.

**Keywords:** wireless, electronics, automation.

## INTRODUCTION

Everyone is wondering how to control all electrical equipment in a house using fingertips. Smart home is a house that connects the main electrical appliances, switches and services to the communication networking, which allow them to be accessed, monitored and controlled remotely. The term remotely means, the all devices can be controlled either form inside or outside the house via communication system [1].

The home automation refers to domestic surroundings that improve the first-class of the resident's lifestyles through facilitating a flexible, relaxed, healthy, and secure environment. Internet based totally domestic automation structures end up the most famous home automation system in global markets [2]. The faraway controlling and monitoring of a house the use of internet calls for pc, which is bigger in size and heavy to hold around. Wireless based home automation system decrease installation cost and effort, and enhance system flexibility and scalability [3]. Domestic automation structures has collections of interconnected gadgets for controlling various features inside a residence [4]. Cellular gadgets are perfect in providing a person interface in a domestic automation gadget, due to their portability and their wide range of abilities. In the house, the consumer may not want to visit a vital manage panel, or not even to the laptop, but use the phone this is commonly placed in nearer proximity to the person [5].

When far from the residence, the consumer might need to check its contemporary agenda for their daily activities. In idea of android based totally home automation system that can provide customers with easy cozy and without obstacles to configurable home automation system [6]. Also the concept can improve the obstacles going through domestic automation device and could enable a home generation atmosphere that appeals to their family. Home Automation is becoming an inevitable factor in our speedy growing environment and present day style [7].

New trends in lifestyle has greater impact on computerized home appliances in a lot of locations. Home automation not only refers to the automation of home equipment in residence, additionally the automation of things that we use in our day by day life including vehicles, telephone and so forth [8]. Automation of appliances become firstly introduced in office for ease of use and additionally for reduction in time and cost intake [9].

The concept of growing a clever home is started in early 20$^{th}$ century. In 1915 to 1920, the emergence of electrical domestic home equipment is started out by domestic servants which meant the family wanted cheap and mechanical substitute. In 1960, the primary "stressed out domestic" became constructed through American obsession[10]. Subsequently when microcontroller was created, a whole lot of work was done to develop the smart home device. At some stage in 1990, clever domestic machine was evolved based at the merging of telematics and verbal exchange machine "The net". Because of the truth that 1990, the internet era and smart domestic system changed into tied strongly. The concept of the "net of things" decorate smart domestic gadget especially[11]. Lately, smart domestic gadget has reached every other stage of intelligence through Wi-Fi communication. The low cost characteristic of Raspberry Pi that may increase in the community has been applied to the smart domestic system. Through Raspberry Pi, trouble with messy wires and the issue of putting in place may be prevented[12]. Besides, the usefulness and simplicity of telephone also can be carried out to smart home system as an attractive consumer interface. Since the early 20th century, a lot of work has been done to develop the Smart Home system. Basically, a Smart Home refers to a home with intelligent to control, monitoring and automate the home system. For example, if the Smart Home is used only for climate scanning, we will be needing only fundamental transmission to perform the task[13]. Particularly, the Android tool can simplest get hold of records about the

home climate from the sensor nodes but it couldn't ship any order to it. However, if the system is needed to monitor, control, and automate the house, the system will be needed a more complex design to enable a duplex communication between the Android device and the sensor nodes. After a duplex communication has been entrenched, only then the Android mechanism could only send and received information to the sensor nodes[14]. The creation of the Smart Home system comes with many different purpose which includes energy efficiency, convenience, safety benefit and entertainment. Recent research shows, Smart Home system development focuses more on assisted living for elderly and disabled people. The purpose is to assist these people so they can live more independently and increased their quality of life at home [15].

Nowadays home automation is a tremendous symbol of the human society civilization. The first automation facility which entered into people's domestic became the automatic washing device, automation air-situation and so on. when people consider domestic automation, maximum of them may additionally believe residing in a smart domestic: One faraway controller for each family equipment, cooking the upward push routinely, starting air conditioner automatically, heating water for bathtub mechanically and shading the window automatically while night time coming. To some extent home automation equals to smart home. They each deliver out clever dwelling circumstance and make our lifestyles more convenient and fast [16].

Domestic automation satisfies the resident's desires and desires through adjustable mild, temperature, ambient music, automatic shading, safety & safety, even association of twine. Home automation technologies are the latest fascination with housing mechanism. However, with the advent of latest digital technology and their combination with older, traditional building technology, the clever domestic is at closing turning into a fact. The fundamental concept of home automation is to display a residing vicinity by the use of sensors and manage structures. Thru adjustable various mechanisms, person can revel in custom designed heat, ventilation, lighting, and different servers in living circumstance. The greater intently regulate the whole residing mechanical machine and loop manipulate device, the intelligent home can provide a more secure, more comfortable, and more power in your price range dwelling circumstance [17].

In this paper, the smart home system composes of 8-channel relay to control home appliances. Raspberry Pi and Android Application. 8-channel relay is used to connect all the home appliances such as lamp, fan and plug. The relay will communicate with Raspberry Pi and the Raspberry Pi will communicate with Android apps with the smartphone. For long distance communication, the Blynk cloud network for smart home system is built by using GPIO. By using this, user can control and check home appliance status via Android Apps (Blynk).

## PROPOSED METHOD

The input component in this project is known as Raspberry Pi will send the data to the Android Apps that shows the status of all home appliances whether it is “ON” or “OFF”. Assuming the current status of one of the home appliances is “ON” and we want to switch it off, then automatically we can use the Android Apps to turn it off. From the Android Apps, the command will directly send back to Raspberry Pi.

Raspberry Pi is connected with 5V relay to control all home appliances by using relay. Relay will become the medium of communication devices which receives data from Raspberry Pi and connect it into the output devices. The output devices in this project are lighting, fan and socket for power supply.

Block diagram shows the project process that starts from the input to output. Figure-1 shows, the block diagram and the process that involved.

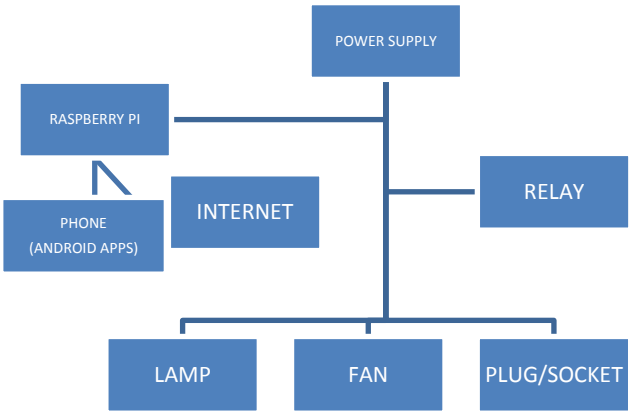


**Figure-1.** Block diagram of the proposed system.

Flowchart in Figure-2 briefly describes about the process that happened in this project. The processes starts from detection of the input device until the output device activation.

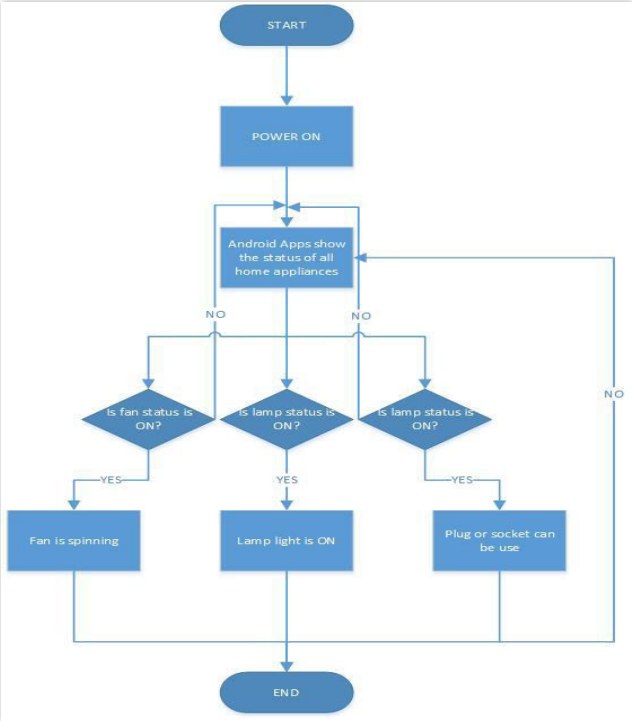


**Figure-2.** Flow chart of the proposed system.

One of the hardware that used in this paper is Raspberry Pi. Raspberry Pi is a small, powerful and lightweight ARM based computer which can do many of the things a desktop PC can do such as word-processing, games or playing High-Definition video. It was developed by the Raspberry Pi Foundation, a UK charity, with the intention of providing low-cost computers and free software to students. Raspberry Pi is based on Broadcom BCM2835 chip. Its small size also makes Raspberry Pi ideal for programming connected home devices like the aforementioned print server, which has given us the power to make every computer, laptop, and cell phone in our network printer-compatible. The Raspberry Pi's General Purpose IO Pins (GPIO) can be used to read data from sensors and send control signals to motors, lights or any circuit. The PiFace interface board makes it much easier to connect things like motors to Raspberry Pi without damaging it. Person can write their very own applications in Python or C to manipulate devices linked to the PiFace board. The WiringPi software program library makes it easy to manipulate and debug the GPIO pins.

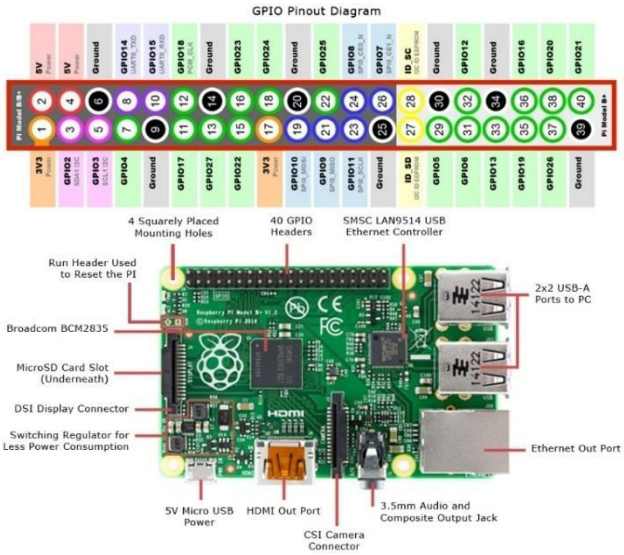


**Figure-3.** PCB Board and GPIO port.

A relay is an electromagnetic switches. The first element is the coil that has the low-energy as a part of the circuit, and can be controlled by using Raspberry Pi. The second part in relay is the transfer switch. This component is a mechanical part that can be listenedas "click" when the relay is switching to any other state. Activating relay by applying 5V on the coil will prompt the switch and alternate the state of relay. The relay is rated as 5V to be connected and the Raspberry Pi GPIO port can best deliver at 3V. So, one transistor is needed to be put in between relay and Raspberry pi. The transistor is basically a strong power transfer. It is able to be activated through the virtual output of the Raspberry Pi board. While the transistor is on, the 5V pin of the Raspberry Pi board will give power to the relay.

The home automation systems end up with the working of the relay circuit. In this home automation system, user can add more devices easily into the system and also can configure more security and functional services. The Raspberry Pi mini-computer can do better to incorporate variety of applications to the users. Since user can make running applications in low power consumption compared to other systems, it is the easiest method to control many electrical appliances easily. Figure 4 shows 5V 8-channel relay.


**Figure-4.** 5V 8-channel relay.

Blynk is a trendy platform that allows person to quick assemble interfaces for controlling and tracking a hardware initiatives from user in iOS and Android devices.

After downloading the Blynk app, consumer can create a venture dashboard and installation buttons, sliders, graphs, and extraordinary widgets onto the display. The use of the widgets can also change pins on and off or display data from many sensors.


**Figure-5.** Blynk interface.

Blynk Cloud is a program that is written on Java platform by using TCP/IP sockets and running on the server. Blynk iOS and Android apps connect to Blynk Cloud by default. Access is free for every Blynk user. Blynk Cloud additionally offer a custom Server distribution for folks who need to install it locally.

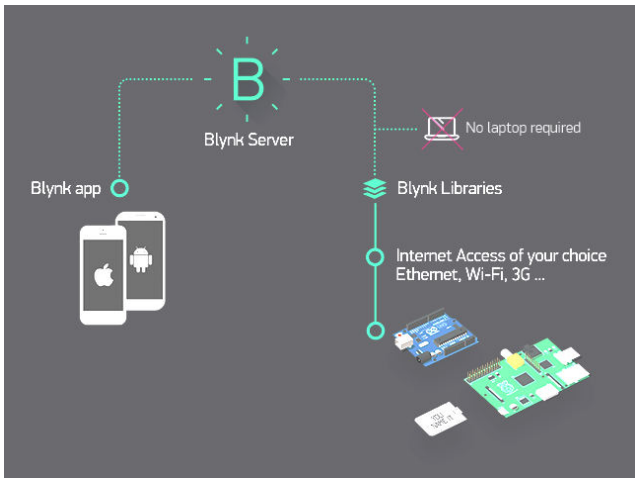


**Figure-6.** Blynk server.

First thing first, a micro SD memory card is prepared for the Raspberry Pi. This involves formatting it properly and putting an Operating System (OS) such as Raspbian for the standard OS for it. Since that Raspberry Pi is act like a mini computer, it should work with any micro SD memory card. The minimum recommended card size is 8GB. Then, download Raspbian at raspberry pi website. After that, copy the files to the micro SD card. The Raspberry Pi needs the screen to do the work. The Raspberry also has HDMI port that can be connected into any monitors like PC monitor or TV to see the interface. The specialties of Raspberry Pi 3B is this mini pc already has Wi-Fi module on it. So it can be connected into any wirelessdevices around it. For the power supply, it uses micro USB port like many other smart phones. In fact, the phone charger can be used to connect it to the power supply. It will turn on all by itself and should be booted for the first time.

WiringPi is a PIN based GPIO accesses library that is written in C for the BCM2835 used in the Raspberry Pi. This WiringPi need to be installed by using Raspberry itself. The tutorial to download it here: http://wiringpi.com/download-and-install/

Next, check that wiringPi is not already installed. In a terminal and run:

$ gpio -v

After getting some results, then it confirms that this system is already installed. The next step is to work out if it is installed via a standard package or from sources. If that software is installed from sources, then the steps are correct. If the steps are wrong, and not installed as a package, the package needs to be removed. These algorithms are used:

1. $ sudo apt-get purge wiringpi
2. $ hash -r
3. Then proceed to next steps.
4. If GIT is not installed, then under any of the Debian releases (e.g. Raspbian), you can install it with:
5. $ sudo apt-get install git-core
6. If errors happened, make sure your Pi is up to date with the latest versions of Raspbian:
7. $ sudo apt-get update
8. $ sudo apt-get upgrade
9. To obtain WiringPi using GIT:
10. $ cd
11. $ git clone git://git.drogon.net/wiringPi
12. If you have already used the clone operation for the first time, then
13. $ cd ~/wiringPi
14. $ git pull origin

To build/install there is a new simplified script:

1. $ cd ~/wiringPi
2. $ ./build

The new build script will be compiled and installed– it does use the sudo command at one point, the script need to be inspected before running it. This is the steps to setup Blynk into Raspberry Pi

1. Connect the Raspberry Pi to the Internet and open its console.
2. Run this command (it updates your OS package repository to include the required packages):

   curl -sL "https://deb.nodesource.com/setup_6.x" | sudo -E bash -
3. Download and build Blynk JS library using npm:

a. sudo apt-get update && sudo apt-get upgrade

b. sudo apt-get install build-essential

c. sudo npm install -g npm

d. sudo npm install -g onoff

e. sudo npm install -g blynk-library

4. Run Blynk test script:

a. blynk-client 715f8cafe95f4a91bae319d0376caa8c

5. To enable Blynk auto restart for Pi, find /etc/rc.local file and add there:

a. node full_path_to_your_script.js <Auth Token>

b. then it will run as normal.

## RESULTS AND DISCUSSIONS

The hardware layout is basically based on wiring board that will be used as the project model. As the hardware layout is prepared then, assemble all the appliances and the Raspberry Pi to the wiring board as shown in Figure-7.

**Figure-7.** Completed project.

Inside of the Raspberry Pi control box is assemble as shown in Figure-8 and Figure-9.

**Figure-8.** Raspberry Pi.

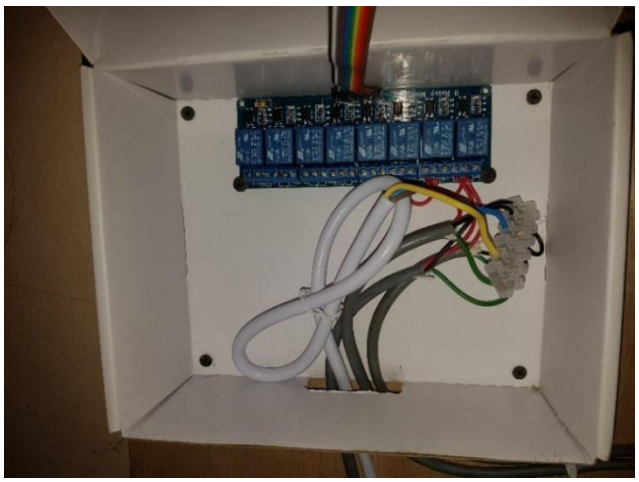

**Figure-9.** Raspberry Pi connected to 5v relay and from relay to the appliances.

## CONCLUSIONS

The android smart home consist of switch devices, access point, web page and android software. This project is designed by using Raspberry Pi and has an embedded system inside it. Then the apps called Blynk that can be downloaded in the IOS or Android Play store for free. The objective was completed when the switch can be turn “ON” and “OFF” by using android apps. It is successfully connected via wireless communication by using Wi-Fi dongle. The smartphone can trigger the switch and control the electrical appliances. The smart home automation based on android apps has high market demand because it uses low cost embedded systems.

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