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Iot Based Home Appliance Control System Using Proteus Simulation Software and Blynk Server

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Abstract: ***Digital Technology has become an integral part of our lives today. Here IoT comes across as a technology which transforms the way we perceive our surroundings. IoT is considered to be a network of interconnected physical objects/things around us that communicate with each other over the Internet. These days, the need for efficient controlling of appliances to minimize power wastage is important as fossils and non-renewable sources of energy are plummeting. So, a smart home system has been developed to monitor and control home appliances remotely from anywhere. This has been executed on a virtual simulator namely Proteus where the hardware circuitry has been designed. Blynk app has been used to send the user's command to the circuit through the local cloud server connected with Arduino and Bluetooth module. The basic home appliances like fan, light and room heater which cause unnecessary wastage of power due to turning on of lights during day time or high-speed fans in winter season can be avoided in this way. At the same time the ability to control our everyday appliances over the internet using IoT makes our lives easier, comfortable and tech savvy. Such a system can be used in a wide range of applications such as home automation, smart agriculture, smart industry.***

Keywords: IoT, Home Automation, Proteus, Blynk App, Arduino, Cloud Server*.*

I. INTRODUCTION

Internet of Things (IoT) is an emerging technology that has established its importance in our daily lives. It allows us to access and control physical objects and devices around us using the Internet as a medium through an IP address. The prospects of making our lives smoother, efficient cost effective is a major factor that has driven the penetration of IoT in our lives. IoT finds applications in a variety of fields like governance, healthcare, agriculture, traffic control smart home systems etc. With the emergence of high-speed mobile networks such as 4G and LTE services along with cheaper and accessible smart phones and other mobile components IoT has become an affordable service which can now be used in regular households, offices, complexes etc. Besides the advantage of having a smart and lavish environment IoT plays a major role in conservation of energy in domains related to automation. With the plummeting of fossil fuels and non- renewable sources of energy it becomes all the more necessary to conserve them. By using IoT and controlling the appliances in our houses we can monitor the wastage of electricity and make conscious efforts towards curbing it. Not only this but the system also helps the elderly and disabled to use this system with a simple click of a button at their fingertips. There are a variety of commercial home automation systems available in the market. However, our aim is to provide a virtual demonstration of the internal functioning of the interconnected components while transmitting and receiving data from the server in real time. In this work a software called Proteus is used to design the electronic circuit containing Arduino board, Bluetooth module and several home appliances like light, fan, room heater and used the same for simulation. Simultaneously we have used an application called Blynk which provides an IoT server for exchanging information through the web. The system describes how we can control our everyday appliances in our home such as light, fan, air conditioner using an Android smartphone and Blynk Server.

II. LITERATURE SURVEY

Smart cities based on IoT technology are becoming popular now a days. Initial goal of IoT was to connect physical devices to internet. Then, Web of Things become prominent to connect sensors to the web, get the data from the web that has been created by the devices [1]. N. Sriskanthan et al. [2] shows the implementation of a home automation using Bluetooth. They use a number controller, that is carried out on a system, which is attached to a micro-controller-primarily based on sensor and tool controllers. Home Automation Protocol (HAP) is proposed to make the communication between devices possible. The system allows more devices to be connected to the host controller. H. Kanma et al. [3] proposes a home automation system using Bluetooth that can be accessed remotely through GPRS. The paper discusses controlling home devices along with fault detection and diagnostics from anywhere. The hardware required for organising Bluetooth conversation is without difficulty to be had and it also provides the necessary bandwidth for the operation in a home.

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Another paper [4] presents the not only overall design of Home Automation System but also this system is Designed to offer aid in an effort to fulfil the wishes of aged and disabled in home. Another research paper [5] provides the design of a wireless home automation system which has been built and implemented and beneficial for aged and disabled human beings with a domestic automation machine that may be completely operated primarily based totally on speech commands. P. Serikul and N. Nakpong [6] presents blynk app and server concept to monitor smart capsule which can be implemented in smart farming. Blynk server is used to send data to the particular device using IoT methodology. P. Siva Nagendra Reddy [7] used android mobile to send data to the Arduino board through Wi-Fi module and Arduino processed them to control all the home appliances.

This system controls the voltage levels of home appliances like fan, light etc. The status of the home appliances is sent to the android mobile phone. In another paper researchers [8] developed a system in which a home automation system is interfaced with mobile devices.

The mobile device and system communicated with each other via Wi-Fi connectivity. Another paper [9] discusses about designing a web-based control of home appliances which allows user to control appliances by clicking on a webpage specially designed to interact, by being anywhere in the world with a computer or a smart phone connected with the Internet. Miss. Aboli Mane [10] used Blynk app in her project of home management system.

Different sensors were connected with NodeMCU. With the help of Wi-Fi, device was connected with Blynk app. On detection of any variance by different sensors, messages were sent to Blynk app. The User Interface (UI) [11] are usually web pages or any Android/Windows applications developed by the researcher. A user can use these applications to access their home appliances using the Internet.

III. PROPOSED SYSTEM

A. Description

The proposed system allows the user to control the appliances of his/her home remotely anytime from anywhere by using smart mobile phones. We have designed Blynk app interface where the particular buttons are used to send user's data to the circuit through the Blynk server. These buttons consist of digital/virtual pins which help to set connection between the particular Arduino pins and the app easily.

The appliances at home which can be turned on/off as required via internet can monitor parameters of household environment easily by reading data in the mobile application. The circuitry consists of Arduino Uno board, Bluetooth module, relays and simulation models of home appliances (in the Proteus software). A DC power supply is used as the power source for Arduino Uno and the relay board in the simulation software.

Being powered up, the Bluetooth module forms a serial communication channel from the circuit to the mobile app. Simultaneously Arduino Uno searches for the server using Authentication Token (previously sent to the user while registering on Blynk app) and connects automatically to the Internet. The server (Blynk Server) is connected to the mobile device (Blynk app) which sends the variable data about ambient conditions to the Arduino Uno board. On pressing the suitable button in application, Arduino Uno gets the instruction via internet server and provides output signal. When the relay is turned on, the appliances get the power from 230V AC source in the simulation software.

The switching circuit can be used for turning the household appliances like fan, air-conditioner, room heater, micro-wave oven etc. on/off. Arduino Uno simulation model is basically Arduino Uno R3 board with 6 analog and 14 digital i/o pins (of which 6 can provide PWM output), operating Voltage- 5 Volts, Input Voltage- 7 to 20 Volts. Bluetooth Module (also specified as HC-05) has the virtual baud rate of 9600 and connected to physical port COM3. The same physical port is maintained in the Bluetooth settings in the system as well as in the Arduino IDE.

Bluetooth module is connected with the Arduino through TXD (pin 1) & RXD (pin 0) pins. TXD pin transmits serial data & RXD pin receives the data to form a connection between Bluetooth module and Arduino Uno board. Blynk app uses Blynk server to send and receive data from the circuit connected using proper authentication token. Relay module consists of four relays connected with diodes, transistors and resistances. AC light connected with a 230v,50 Hz AC supply. a 12V DC fan, a yellow LED light and a room heater is also connected. All these four home appliances are connected with separated relays. They are all connected with pin nos. 10(OC1B/PB2), 11(MOSI/OC2A/PB3), 12(MISO/PB4), 13(SCK/PB5). The Arduino IDE is used to write the code for Arduino board and upload it in the Arduino model of the simulation software. After clicking the run button in the simulator, the circuit charges up and finds Bluetooth connection to form a serial communication channel. After that the transfer of data occurs using Blynk server and appliances turn ON/OFF based on user's command.

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B. Block Diagram

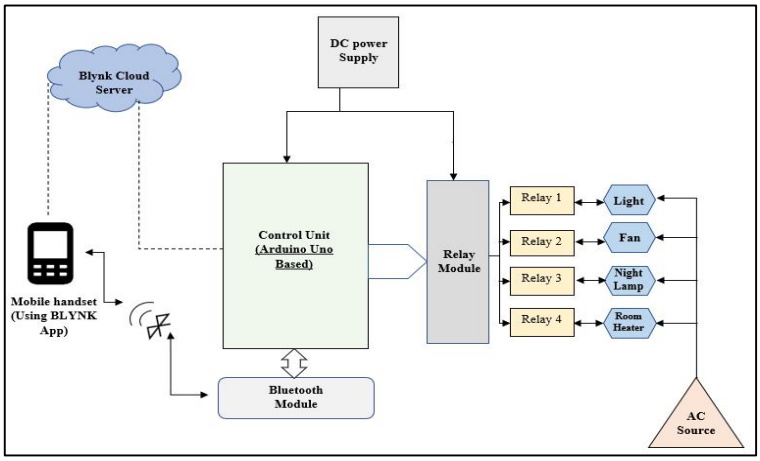


Fig. 1 Block Diagram

Fig. 1 shows the block diagram of entire project where the software, server and hardware part are shown. As per our proposed system the Blynk server is used to form the bridge of communication between hardware components and software (Blynk app). Arduino is used as control unit and Bluetooth module is connected with it for channel establishment. Upon connecting the Bluetooth module with the mobile device Arduino searches for proper server address and connects with it using Authentication Token. The user is now ready to send command to the particular circuit through server. Relay modules are turned ON/OFF according to the user's demand by clicking on respective buttons in the Blynk App. After clicking on a button, a request will be sent to the server then to the respective Arduino pin and the home appliances will be turned ON/OFF according to that command signal.

C. Flow Chart

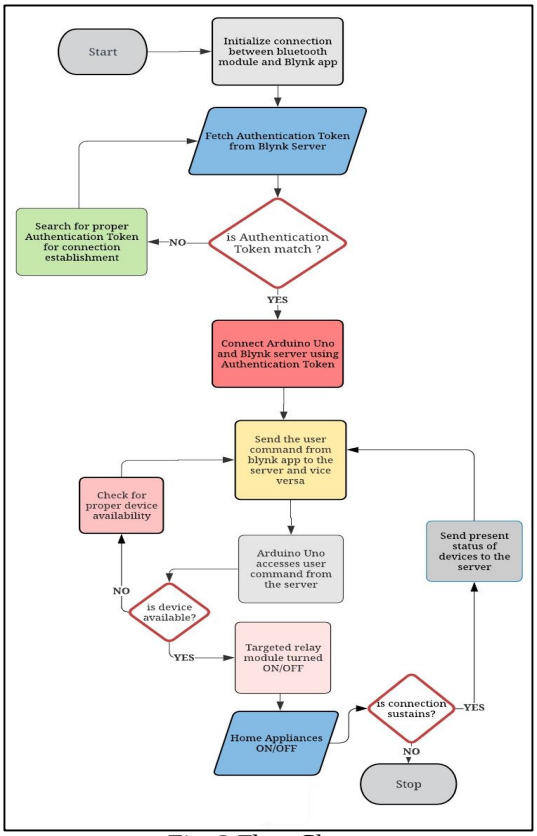


Fig. 2 Flow Chart

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Fig. 2 shows the entire flow chart of home appliance control system. At first the connection between Bluetooth module in the simulation software and Blynk app is established. Simultaneously the Authentication Token is being verified with the proper Arduino code for fetching the particular server using that token. If the token matches the connection between Blynk server and Arduino uno board is established. After establishing the connection user sends command using buttons (previously designed in Blynk app) to the server and the Arduino module accesses those command from the server. After that Arduino checks for device availability. If the particular device is connected with targeted relay module, the device will be turned ON/OFF by forming connection with the relay circuit. Simultaneously the present status of the devices is sent to the server and can be accessed by the users according to their need.

D. Circuit Diagram

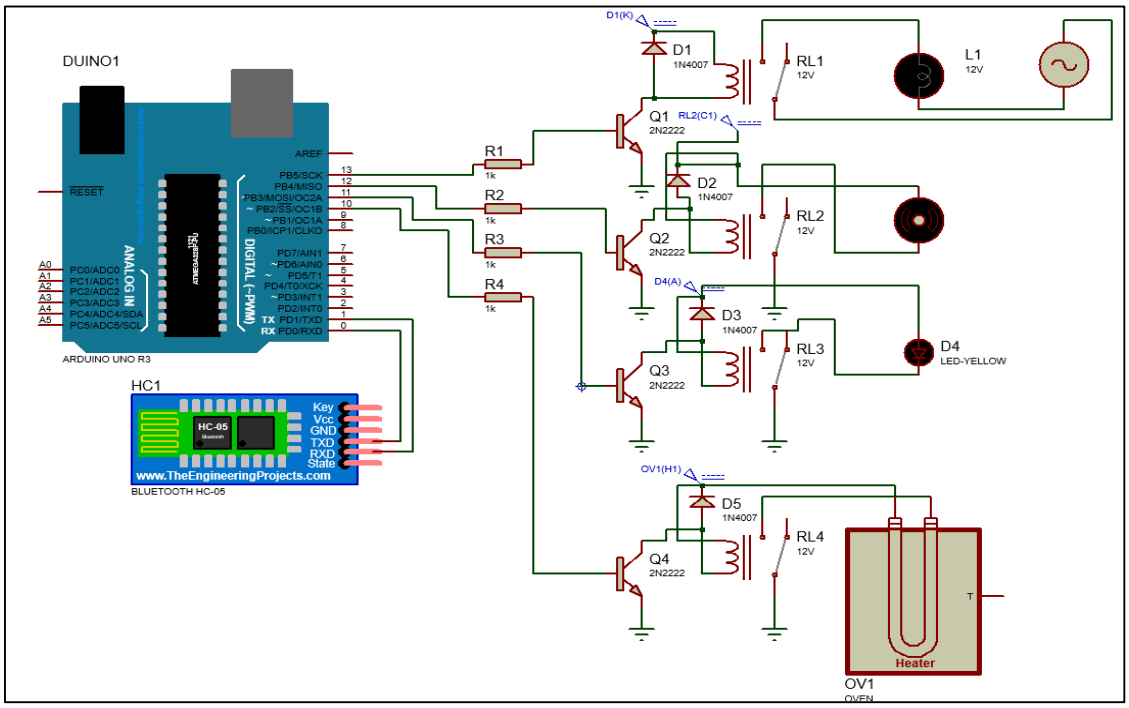


Fig. 3 Circuit Diagram

Fig. 3 displays the simulation model of the hardware circuit designed in Proteus simulation software. The Arduino uno board is connected with Bluetooth module (HC-05) using TXD and RXD pins. 1k ohm resistances are connected with the digital pins 10,11,12,13 respectively. A NPN transistor, PN junction diode and relay circuit is used to form relay module and a particular device (AC light, dc fan, LED, room heater) is connected with these relay modules. Also, 5V DC supply is used in each module circuitry. When a high signal (1) arrives at base terminal of the transistor the current in collector terminal starts increasing and results in current flow inside the coil of relay circuit. A magnetic field develops across the coil and electromagnetic induction force appears at the output terminal of relay circuit. This particular force attracts the armature of the coil and the circuit connection between relay and device is established. The current flows through the circuit which turns ON that particular device. When a low (0) signal appears at the input of relay module, the electromagnetic induction force starts decreasing. This reduces the attraction and makes the circuit open. The particular device turns OFF after certain period of time.

E. Components Used

In this project we've used Proteus simulation software to simulate the circuit designed in the simulator. The circuit consists of Arduino Uno, Bluetooth module (HC-05), relay circuit made up with diode, transistor, relay module and the simulation model of basic home appliances like light, fan, lamp, room heater. To control the circuit using mobile device, Blynk app is used. It provides an interface to design switches or buttons and assign particular digital pins with those buttons. Blynk app also provides Blynk server to communicate between simulation circuit and the mobile app using proper authentication token.

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F. Algorithm

1) *Step 1:* Start.
2) *Step 2:* Register on Blynk server and fetch authentication token.
3) *Step 3:* Use the obtained token in the Arduino code
4) *Step 4:* Simulate the circuit designed in Proteus to establish connection between Arduino and Blynk Server.
5) *Step 5:* Press the run button in Blynk app to create the gateway between Blynk server and app.
6) *Step 6:* Establish connection between simulation circuit and Blynk app by switching on Bluetooth in mobile and simulation software.
7) *Step 7:* Press on/off button in the app to send a signal to the circuit from app via server to switch on/off the desired appliance.
8) *Step 8:* Stop.

IV. SIMULATION RESULT ANALYSIS

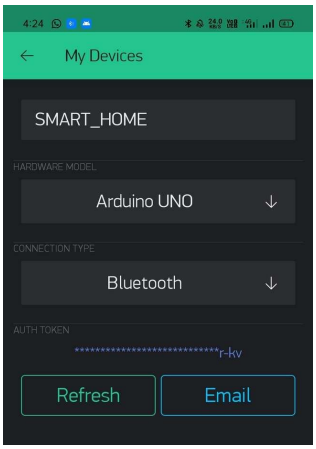


Fig. 4 Registration page in Blynk app

Fig. 4 displays the registration page in Blynk app. It shows how the board selection (Arduino Uno) and connection (Bluetooth) is established. After registering in the app an Authentication Token delivers of the respective e-mail id. Using that token Arduino connects with the Blynk server.

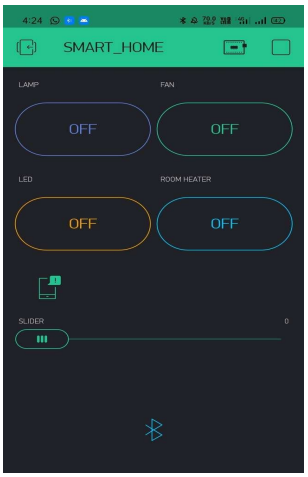


Fig. 5

Fig. 5 shows the user interface of the Blynk app. There are 4 devices lined up i.e., Lamp, Fan, LED, Room heater which have switches for turning ON/OFF devices. Also, the Bluetooth client is there to establish connection between app and circuit in the Proteus simulator. A slider is used to regulate fan speed in the app. The first button (for light) is interfaced with digital pin no. 13 and the default switch position is low. All other buttons are connected with targeted digital pins respectively.

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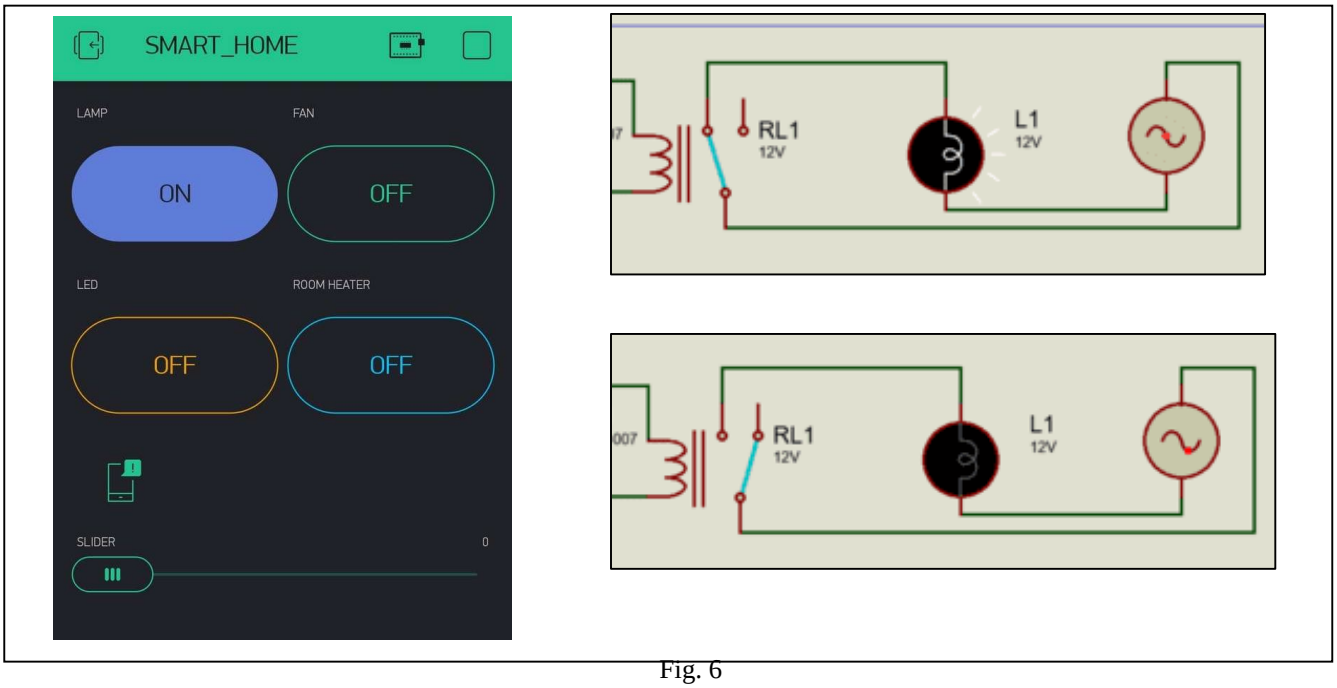


Fig. 6

Fig. 6 display the simulation result of the system. When user clicks of ON button, a high signal passes to the particular digital pin of Arduino through Blynk server. The light turns ON after receiving that signal from relay module. When user clicks of OFF switch, a low signal passes to that digital pin of Arduino. The light turns OFF after receiving that signal from relay module.

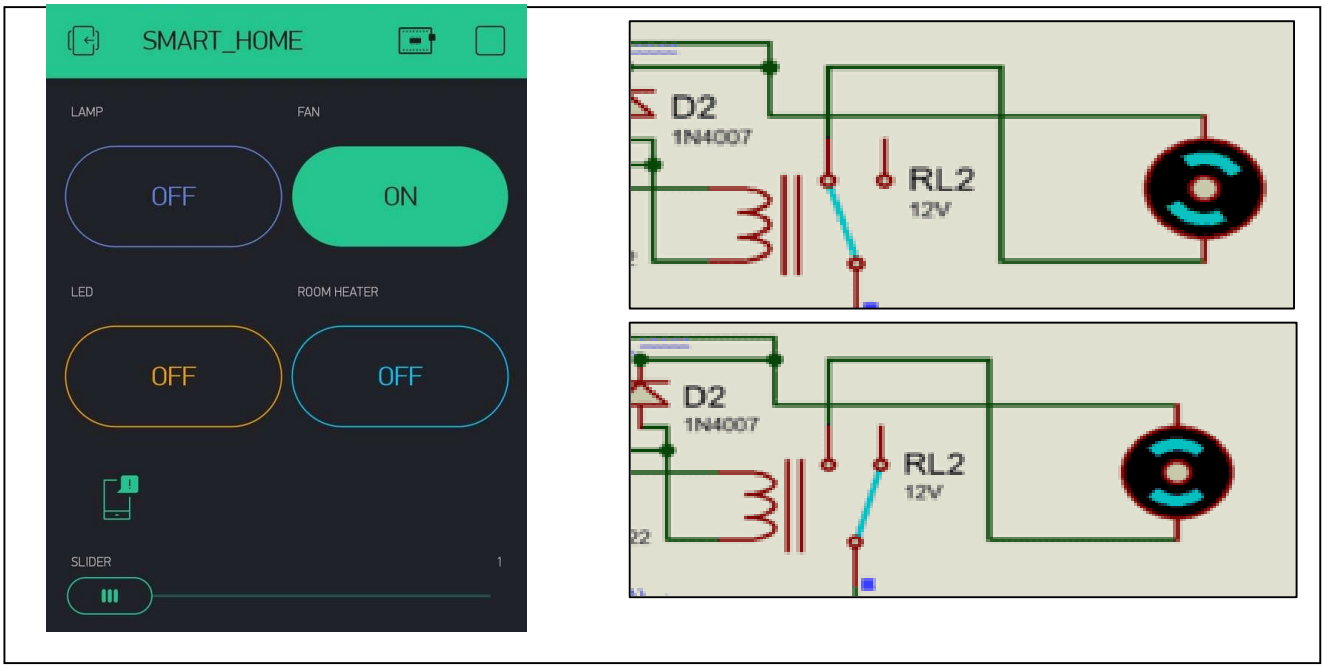


Fig. 7

Fig. 7 display the simulation result of the system. When user clicks of ON button, a high signal passes to the particular digital pin of Arduino through Blynk server. The fan turns ON after receiving that signal from relay module. When user clicks of OFF switch, a low signal passes to that digital pin of Arduino. The fan turns OFF after receiving that signal from relay module.

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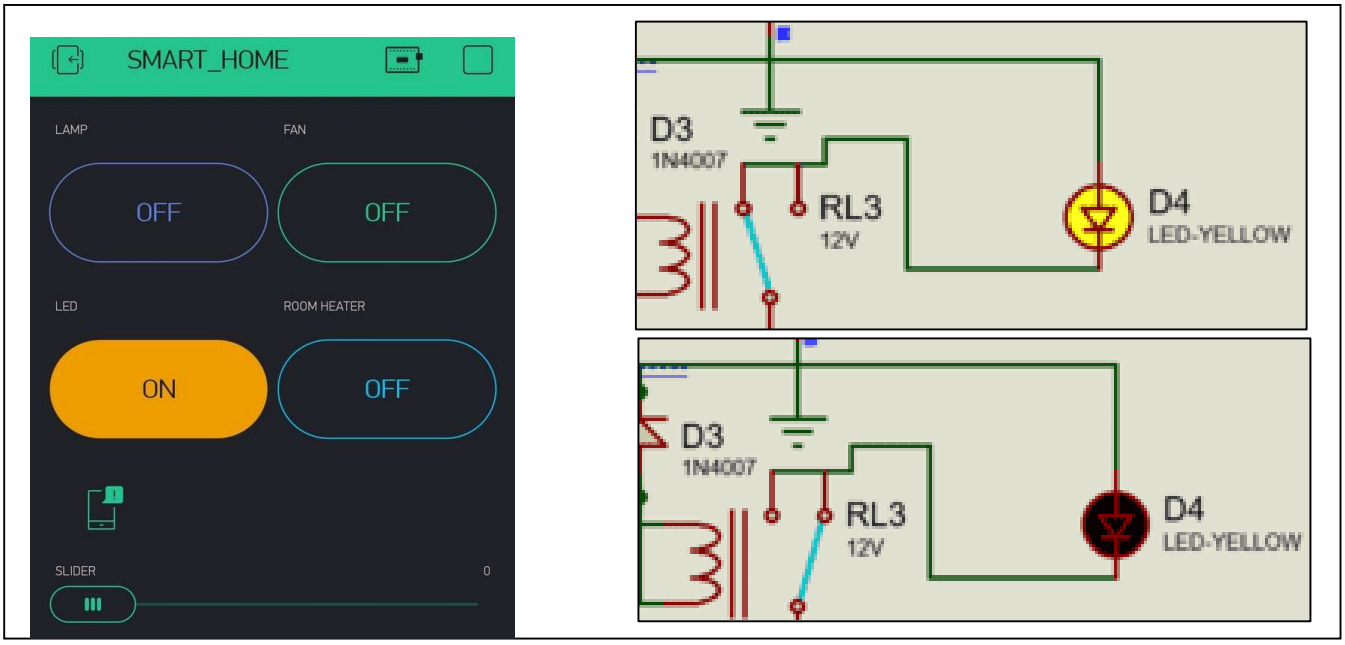


Fig. 8

Fig. 8 display the simulation result of the system. When user clicks of ON button, a high signal passes to the particular digital pin of Arduino through Blynk server. The LED turns ON after receiving that signal from relay module. When user clicks of OFF switch, a low signal passes to that digital pin of Arduino. The fan turns OFF after receiving that signal from relay module.

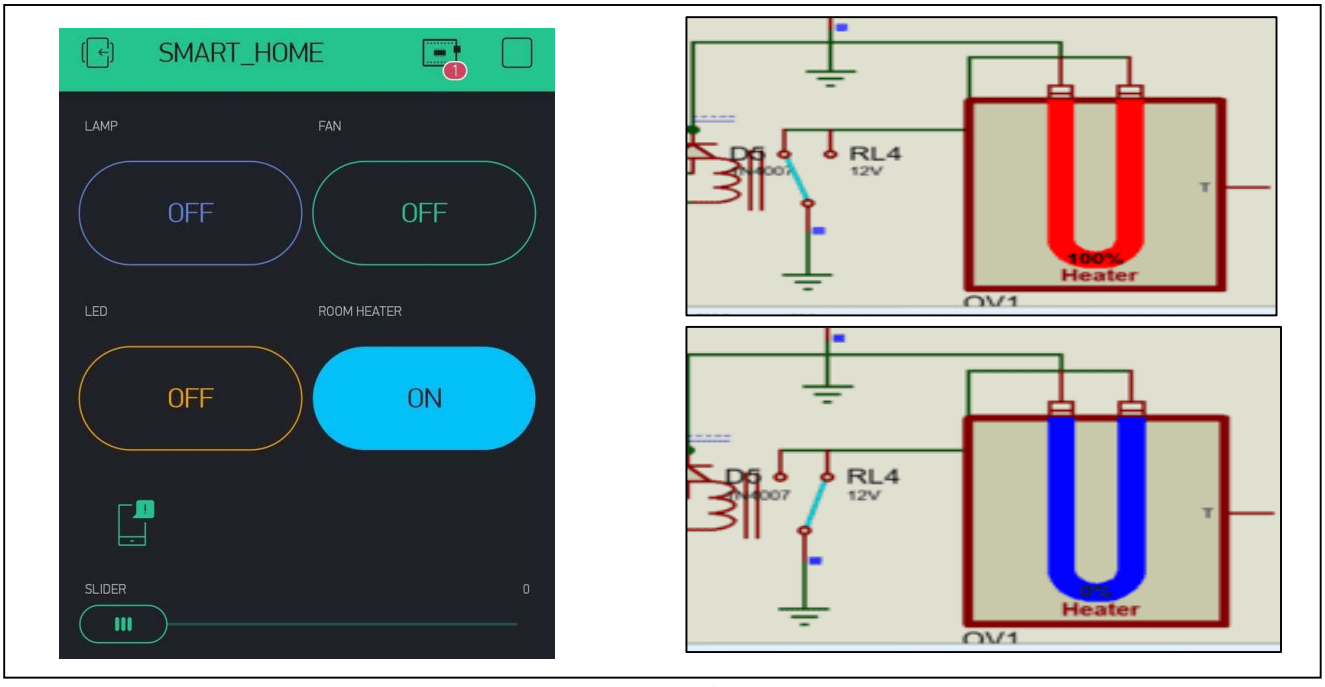


Fig. 9

Fig. 9 display the simulation result of the system. When user clicks of ON button, a high signal passes to the particular digital pin of Arduino through Blynk server. The room heater turns ON after receiving that signal from relay module. When user clicks of OFF switch, a low signal passes to that digital pin of Arduino. The room heater turns OFF after receiving that signal from relay module.

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V. APPLICATIONS

The smart home appliance control system has a variety of prospects in our daily lives. It can be incorporated in diverse aspects our surroundings to make our lives easier and comfortable. There are various applications of our project which can be easily incorporated in our daily life. It is Easy to use for old aged and physically challenged people. This system has great usage in hospitals, corporates, schools, colleges. It helps to enhance home safety and security by incorporating other sensors and technologies. It minimizes power wastage in industries and other sectors. The availability of server makes it possible to operate home appliances from anywhere.

VI. FUTURE SCOPE

Our system can be improvised by adding various new features and technologies by including sensors, actuators, etc to provide an automated experience to users. There are some scopes of improvement in this project. Fingerprint sensors and smart lock security system could be incorporated to enhance home security. Video camera surveillance can be used in addition with the above. Home air quality can be monitored with the help of optical sensors. Water quality can be monitored by using turbidity sensors etc. Wi-Fi can be used instead of Bluetooth to enable long range communication. Smart alarm and notifications can be used minimize power wastage.

VII.CONCLUSION

In this project, we have presented the step-by-step procedure of smart home automation controller unit. With the help of the design control unit, home appliance can be converted into a smart and intelligent device using IoT. The working of the proposed model was experimentally shown with help of connecting the devices. The proposed system has two advantages. First, using the IoT connectivity, we can monitor and access our smart home easily from anywhere, which will definitely will prove to be energy efficient [12]. Secondly, it acts has a helping hand for the old age and differently abled person. Modifying the system further according to the area of application can make this system more effective and efficient than the existing ones to obtain accurate results. Since smart phones are widely used nowadays, this user-friendly system can be used for benefitting the mass. The cost of the system is also within reach. Not only old-aged or physically challenged people can be benefitted using this, but any person with a smart phone can monitor and control the electronic devices without much difficulty. Thus, it has immense applications in a variety of sectors.

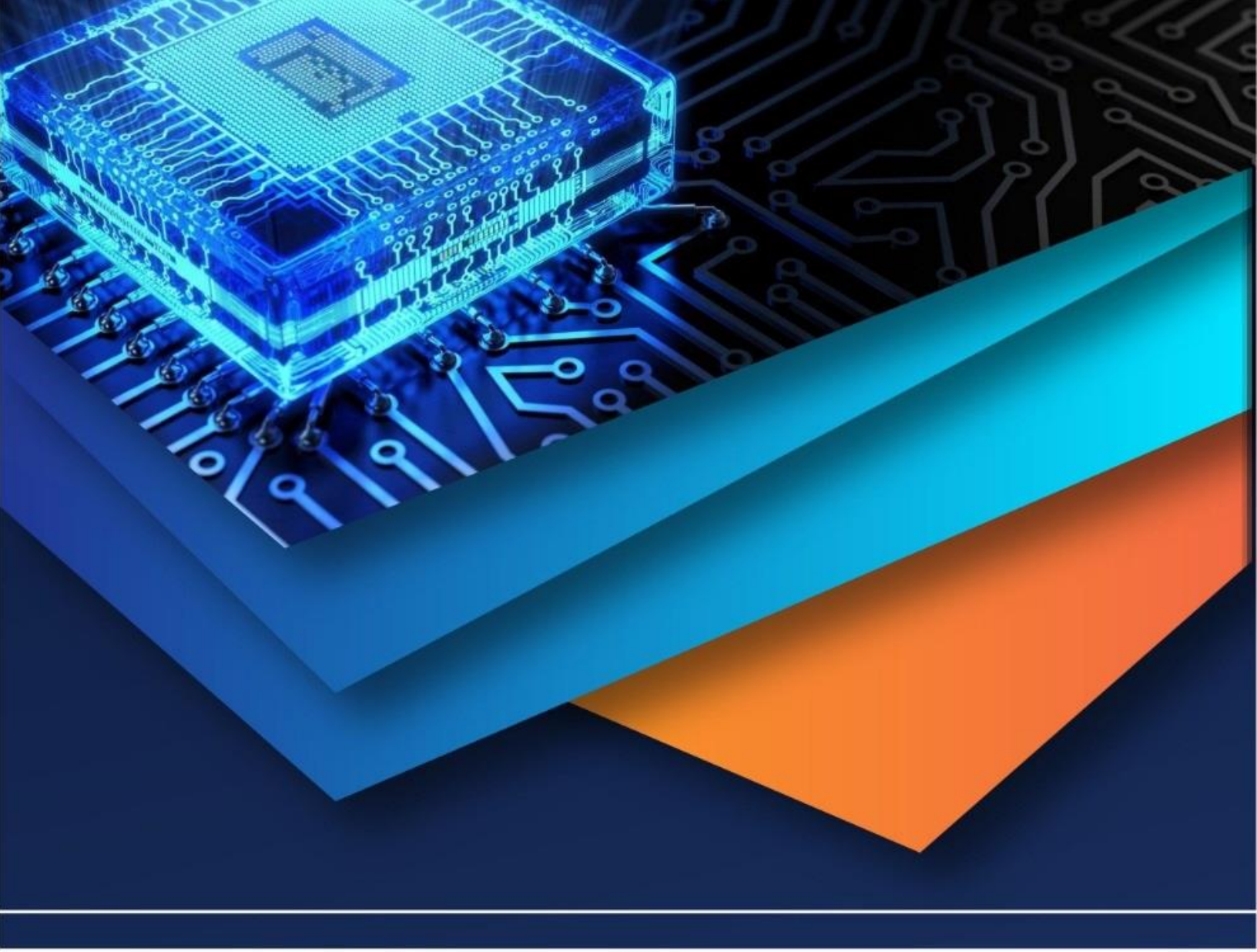
VIII. ACKNOWLEDGEMENT

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