

## **SMART HOME AUTOMATION THROUGH ESP8266**

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### **ABSTRACT**

A home automation system controls or monitors home attributes such as lighting, climate and appliances. Home automation system may also include home security such as access control and alarm system. A home automation system typically connects the controlled devices to a central hub or a "gateway". The user interface for control of the system uses tablet or desktop computers, a mobile application or a web interface that may also be accessible offsite through the Internet.

Our paper proposes a unique home automation system where its efficiency and accuracy can be improved. It comprises of Arduino UNO R3 interfaced with Node MCU (esp8266) which is a Wi-Fi module used to transmit data over internet, electromagnetic relays, PIR sensor, DHT11 sensor, MQ2 sensor, Flame sensor. This developed system works when there is any motion within the defined sensor range, any flame/gas within the defined sensor range and it can also be controlled through the mobile application. Blynk application has been configured with the system so that it works flawlessly on both iOS and android devices. The developed microcontroller has been configured with the Blynk server which makes the home appliances work remotely and eliminates the need for a dedicated PC server. The final prototype is also configured with google assistant so that the relays can be triggered with the voice too and this system has been successfully developed, and the working prototype has been tested with various test cases.

**KEYWORDS:** Arduino UNO R3, Node MCU, PIR, MQ2, DHT11, Flame, relay.

### **1. INTRODUCTION**

IoT is a concept which helps to build a wireless network among the different devices accessed through internet and various IP protocols. Basically IoT creates an eco-system among the devices make it accessible remotely and things in IoT represents the devices like sensors, microcontrollers and mobile phones that is connected to a wireless network.

Evolution of technology has always encouraged the use of Wi-Fi which eradicate the need of wired connection and thus reducing the cost and complexity of the system. The resulting network is usually referred to Internet of things (IoT). Evolution of IoT has solved plethora of real time problems and have improved the flexibility of various existing systems. In this case the Wi-Fi module, Node MCU (esp8266), act as a gateway to connect the home appliances to the Blynk server and those appliances can be triggered remotely through the Blynk mobile app. Additionally, this Internet based home automation system has been integrated with passive infrared sensor (PIR sensor) which makes the system work when there is any physical movement.

This project depicts a home automation system where its efficiency and accuracy is increased by integrating the components to the Arduino UNO and mobile application. Through this system we can monitor and control everything in the house such as temperature, humidity etc., We need to select the correct relay module that is required. Here we used a single channel relay module to control the lamp through Blynk Application.

### **2. LITERATURE SURVEY**

Various researchers have been made different researches for developing this project. However, they serve a different-technologies implemented. Some of those papers are mentioned below stating their technology and application.

M. Muthukumaran and A.Guruveswaran developed a Bluetooth based home automation system. In Bluetooth based home automation system the home appliances are connected to the Arduino BT board at input output

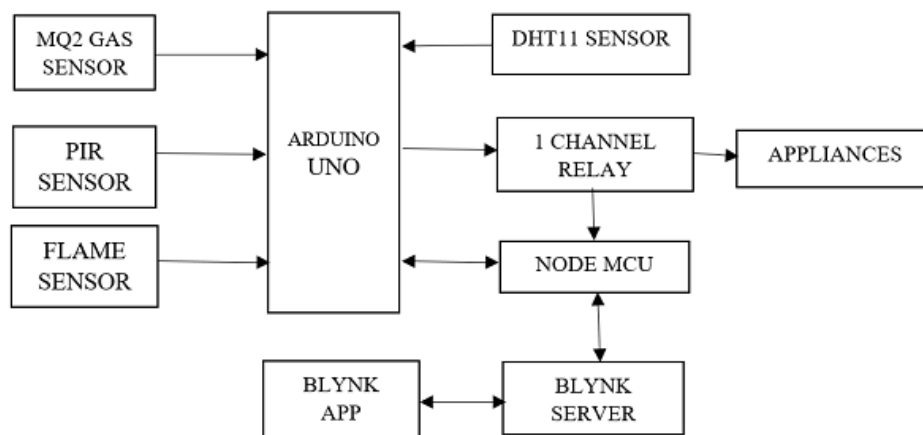
ports using relay. The program of Arduino BT board is based on high level interactive C language of microcontrollers; the connection is made via Bluetooth. The password protection is provided so only authorized user is allowed to access the appliances. The Bluetooth connection is established between Arduino BT board and phone for wireless communication. In this system the python script is used and it can install on any of the Symbian OS environment, it is portable. One circuit is designed and implemented for receiving the feedback from the phone, which indicate the status of the device.

Shuang-Hua H Yang developed a Zigbee based Home automation system. For this the Wi-Fi network is used, which uses the four switch port standard wireless ADSL modern router. The network SSID and security Wi-Fi parameter are preconfigured. The message for security purpose first process by the virtual home algorithm and when it is declared safe it is re-encrypted and forward to the real network device of the home. Over Zigbee network, Zigbee controller sent messages to the end. The safety and security of all messages that are received by the virtual home algorithm. To reduce the expense of the system and the intrusiveness of respective installation of the system Zigbee communication is helpful.

Kok Wai Chan and Rozitz Teymourzadeh developed a Smart GSM based Home automation system in which the operation is controlled using a mobile phone. Because of the mobile phone and GSM technology, the GSM based home automation is lure to research. The SMS based home automation, GPRS based home automation and dual tone multi frequency (DTMF) based home automation, these options we considered mainly for communication in GSM.

### 3. BLOCK DIAGRAM

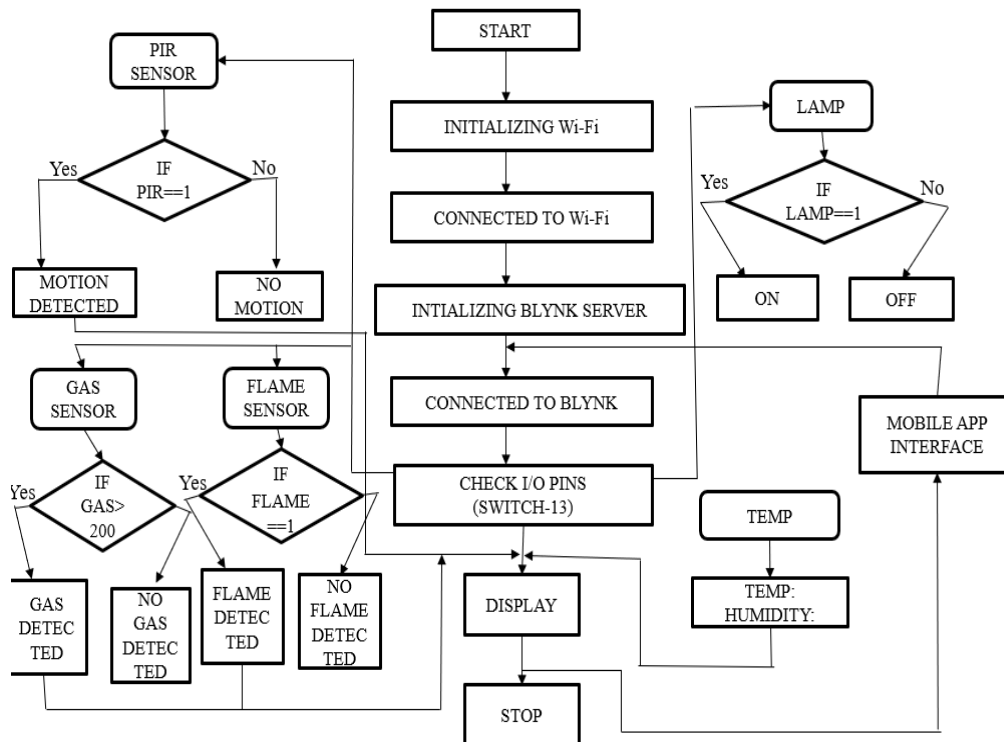
Figure 1. The block diagram of our system consists of Arduino UNO, Node MCU, MQ2 Gas sensor, Flame sensor, DHT11 sensor and 1 channel relay. In this the one channel relay acts a switch i.e., it is an output device. Here we connected the one channel relay to the appliances and the appliance is a lamp. The sensors are given as input to the Arduino UNO and the Arduino is interfaced with Node MCU for serial communication. The purpose of Node MCU is that the application which we are using works well for Node MCU. Here the sensors will detect the gas/flame/temperature. The PIR sensor will detect the motion in the specified threshold range. The Blynk application is connected to Blynk server.



### 4. FLOW CHART

The figure shows the flowchart of the proposed system which the whole operation of the system and controlled by a mobile application. The flowchart indicates the whole operation of the system and controlled by a mobile application. The focus of the project is to automate the process of triggering the home appliances. The program is developed through Arduino's IDE has been used as an interface between Blynk app and microcontroller, node MCU to improve accuracy.

To improve the flexibility the relays are configured with google assistant using IFTTT, a free web-based service creates chain of simple conditional statements, so that relays can be triggered.

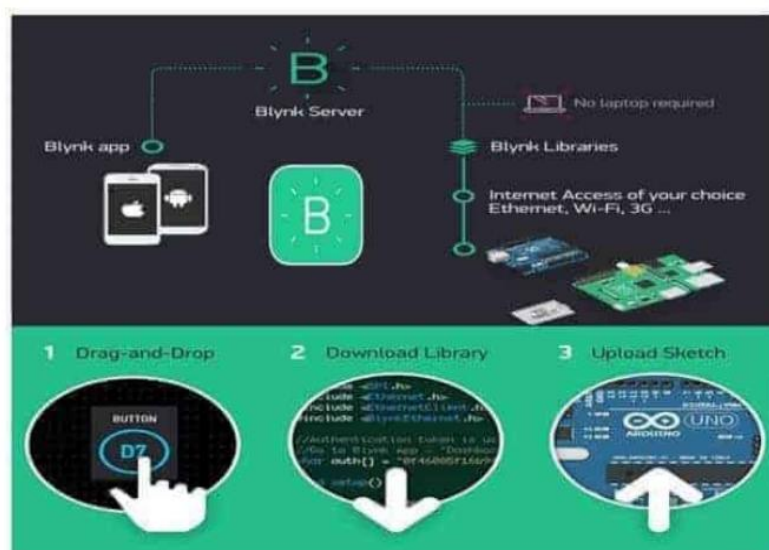


### 5. BLYNK APPLICATION

Figure.2. Blynk is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardware projects from your iOS and Android device

After downloading the Blynk app, you can create a project dashboard and arrange buttons, sliders, graphs and other widgets on the screen

Blynk was a designer of the Internet Of Things. It can control hardware remotely, it can store data visualize it and do many other cool things.



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

Blynk works over the internet. This means that the hardware you choose should be able to connect the internet.

Some of the boards, like Arduino Uno will need an Ethernet or Wi-Fi shield to communicate, others are already internet enabled: like the ESP8266, Raspberry Pi with Wi-Fi dongle, particle photon or Spark Fun Blynk Board.

A smartphone the Blynk App is a well-designed interface builder. It works on both iOS and Android.

### 6. SIMULATION RESULTS

Figure.3 Below is the simulation diagram of the hardware which shows the connections for Arduino, Node MCU and the remaining sensors. It shows that the transmitter of Arduino is interfaced with the transmitter of Node. If there is any detection in flame or smoke then the notification will be displayed like ‘Fire was detected’ else it will display ‘Fire was not detected’. The lamp is controlled using the Blynk application. In the component is selected in the application and the component should be renamed. After selecting the pins of the lamp in the mobile then we will click on play button. The project starts running and the lamp will be ON and OFF simultaneously.

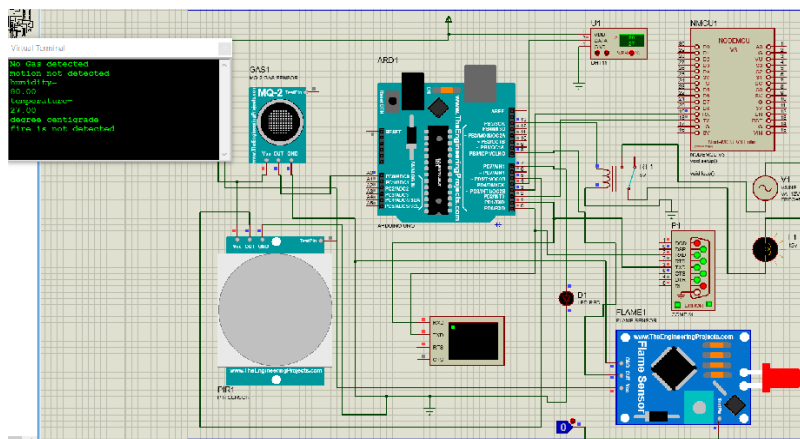


Figure. 4 shows the simulation result of the project. Here we cannot test the sensors so we connected a logic toggle to flame sensor. The led is interfaced to flame sensor which shows an indication when flame is detected. If we change the logic toggle to ‘1’ then the Led will ON and the message will be displayed as “Fire was Detected” and if change the logic toggle to ‘0’ then the Led will be OFF and the message will be displayed as “Fire was not detected”. We can also test the remaining sensors using logic toggle port.

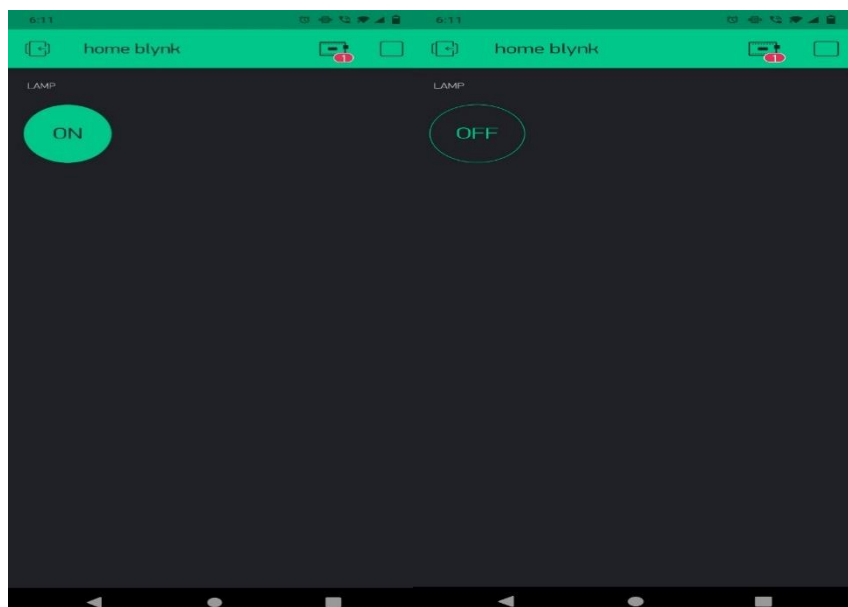


Figure.5 is the connection of Lamp in the Blynk Application. In this we will select the device name called as Button and we will rename it as the required component i.e., LAMP. We will select the mode of operation as digital and we will assign the pin number. After doing all this we need to include the authentication token in the program which is generated by the application. Now we will run the simulation and simultaneously we will run the application in mobile. So we can control the operation of lamp using the application. We can connect more than one device in the application.

## **7. CONCLUSION AND FUTURE SCOPE**

The working prototype of home automation system has been tested and implemented. Since it consists of PIR sensor, if there is any motion detected in house when the user is unavailable then user will receive a notification. If the MQ2 sensor reaches its threshold values then the user will receive notification like "Gas Detected". The similar thing/operation happens with the rest of the sensors. The temperature sensor indicates the temperature and humidity values, based on these values we can operate Air Conditioners, Fans and Lights in house. All the appliances connected to the board can be monitored remotely with the Blynk mobile application which works flawlessly on both the android and iOS devices as well. This prototype can be used to solve plethora of real-world problems, automating the street lights, For instance a substantial amount of electricity can be saved by switching off the appliances/devices when there is no any physical motion. As a future enhancement, we are also working on configuring the ultrasonic sensor (HC-SR04) with this prototype which would allow us to elicit data such as distance to and from an object/human and with those data the precision of human motion detection can be improved. To sum it up all, perhaps this prototype might sound simple yet the concept behind this is such a gamechanger.

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