

# Proximity Hand Gesture based Home Automation System using Arduino and APDS-9960

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## ABSTRACT

In this era of science and technology, computer science and its subordinates fields have gained popularity and success. With introduction of Internet of Things (IoT) & home automation, quality of life is improved and not only that but different field like manufacturing industries and security has also advanced. Present technologies include different type of home automation techniques such as Bluetooth based, Wi-Fi based, Voice recognition based etc. In addition to the presently available technologies in the field of home automation hand gesture based home automation has taken a leap in the present market. It has generated new demand for making home automation system based on single hand gesture to switch on/off electrical appliances. In this research paper presently available techniques are compared with proposed home automation system based on simple hand gesture.

## General Terms

Home automation, Internet of things, Embedded system, Hand, Gesture, Bluetooth, Wi-Fi, Voice.

## Keywords

Gesture based home automation, Bluetooth home automation, Wi-Fi home automation, Automation using voice reorganization.

## 1. INTRODUCTION

Automation is in the zenith of its age. In the present scenario automation is taking place in almost every aspects and field of life. It may be agriculture, industry, luxury, manufacturing etc. The origin of automation started with different home automation techniques which include WiFi/internet, voice oriented, Bluetooth. In this available techniques different components such as mobiles phones, Bluetooth devices and sensors, wireless LAN is used. Another technique, that is gesture based home automation is trending and different developments for the have been done. Here in this paper, a simple technique using hand gesture is presented for home automation. The system is efficient, compact and compatible. It uses a simple proximity sensor to catch hand movements and switch on/off electrical appliances. Compared to other available home automation techniques it is easy to implement, needs less components and is favorable in all the scenarios. also comparison between different home automation techniques in terms of cost, hardware efficiency and real time working has been presented.

## 2. AVAILABLE TECHNIQUES

There are different techniques available for home automation. Some of the techniques are: 1) Bluetooth based Home Automation. 2) Wi-Fi/Internet based home automation. 3)

Voice Controlled home automation. Below are the detailed explanations for different home automation techniques.

### 2.1 Bluetooth Home Automation

Home automation based on Bluetooth and smartphone is easy to implement and is cost effective as well. In the paper Exploiting Bluetooth on android Mobile Devices for home Security Application, Josh Potts and Samsak Sukittanon provided a unique solution of Bluetooth based Home automation system[3]. Bluetooth is a collection of piconets and scatternets. The system requires an Arduino BT board, Mobile device and Relay. The Bluetooth board has a Range of approximately 10-100 meters, a data rate of 3 Mbps and a frequency of 2.4GHz. Bluetooth based home automation systems were designed to remove the traditional wired or cabled systems. Using Bluetooth in automation allows seven users to connect with a master piconet at the same time creating one master and seven slave network. It acts as an infrastructural network. When user sends signals using the Mobile devices with the help of Bluetooth, the signal is carry forwarded or transmitted to the Arduino BT board. The Arduino BT board acts as a master piconet and sends the signal to the electrical appliances to check for three different values. The appliances may be in on/off state or in ajar. The user has to wait for the response from the appliances to go further and switch on/off the appliance. The system is low cost and power consumption is less. While there are some drawbacks to the system as well as limited appliances can be controlled and and each and every appliance has to be in the range of Bluetooth.

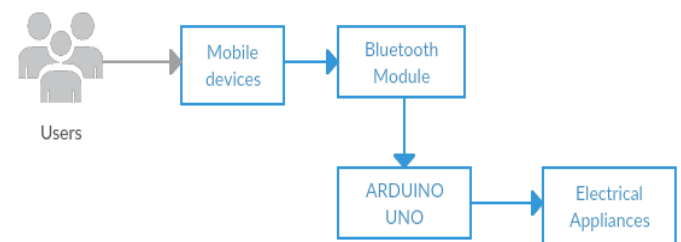


Figure 2.1 Working of Bluetooth Home Automation

### 2.2 Wi-Fi/Internet Home Automation.

The present world is fast growing. Compatibility and portability is one of the major requirements. There are systems and devices created which are wireless and can be accessible at any place at any time. In the paper Design and Implementation of a WiFi based Home Automation System, Ahmed ElShafee and Karim Alaa Hamed [2], have presented a prototype solution for WiFi based home automation system. The system requires a Mobile device or Personal Computer, Server, Arduino Board with WiFi and Relays [5]. Wi-Fi based

Home Automation came to lights when requirements could not be met by traditional Bluetooth and cable based systems. The system is long ranged and multifunctional. This system is mainly used for temperature and humidity control, Door status, Light and smoke detection. The system works on a simple client server architecture. The Mobile devices or PCs access the local server through browsers. The server interface is created using HTML, CSS etc. and programming and implementation is done through ASP.net and Embedded System. When a user is connected to the server it gives a command to access any appliance. On the other had the local server, Mobile Devices and Electrical Appliances are connected to the server using Wi-Fi. The command from the user is sent to the Arduino Board through Wi-Fi and the Wi-Fi module on the other hand receives the the signal and switches on/off the appliance. The system being wireless and accessible through Internet makes it long ranged. The only drawback the system has is that in case of Internet Breakdown the system will be still and control to the appliances will be lost.

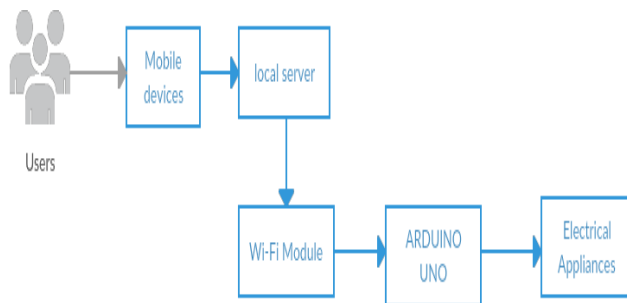


Figure 2.2 Working of Wi-Fi/Internet Home Automation

### 2.3 Voice Controlled Home Automation System.

When it comes to home automation the Voice Controlled Home Automation is one of the most famous techniques. Automation is considered as a luxury itself and voice controlled Home automation provides an essence to it [4]. Human Beings consider Voice as the simplest form of communication and using voice to control appliances makes it even easier for layman to use such a system. Sonali Sen, Shamik Chakrabarty, Raghav Toshniwal, Ankita Bhaumik in the paper, Design of an Intelligent Voice Controlled Home Automation System have proposed a precise solution for voice controlled home automation [1]. The system requires a Arduino UNO, Arduino based smartphone, Relay board and Bluetooth module. The system works on a basic principle of conversion from text to speech. The user is connected to Bluetooth using a Mobile device and sends a voice command through it. The Command is then transmitted to the Arduino board where the conversion from voice to speech is done using Arduino Sketch. If the text matches the text in the code, then the appliance is switched on/off. In case of a miss “text mismatch”, message shows up. The system is easy to use but has its drawbacks. It needs efficient programming and user efficiency.

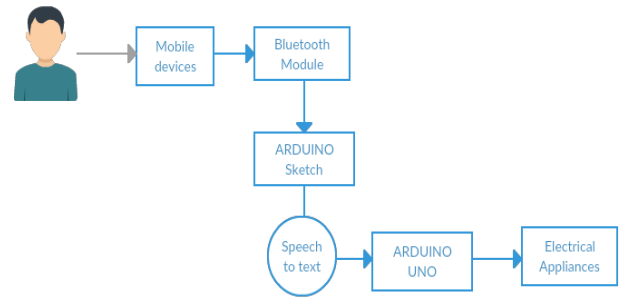


Figure 2.3 Working of Voice Controlled Home Automation System

## 3. PROXIMITY HAND GESTURE BASED HOME AUTOMATION SYSTEM.

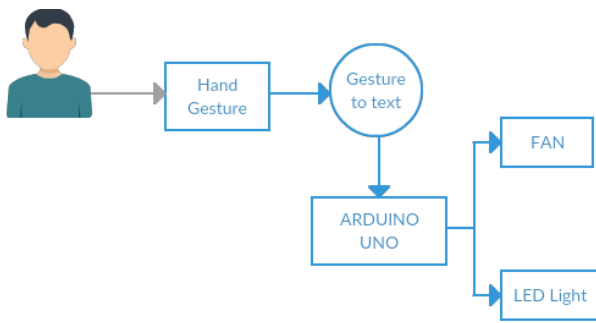
One of the developing and trending home automation technique is Gesture based Home Automation. The system is developed using different techniques and in this paper, a technique is proposed using proximity of hand to operate electrical appliances. The paper covers the Hardware and Software requirements as well as working of the system with System diagram and flow diagram with prototype pictures.

### 3.1 Software And Hardware Requirements.

- 1) SOFTWARE REQUIREMENTS
  - Arduino IDE
  - Embedded C
  - APDS Library
- 2) HARDWARE REQUIREMENTS
  - Arduino UNO.
  - 5V DC Relay
  - 5V DC Motor
  - APDS-9960
  - LED
  - BATTERY

### 3.2 WORKING.

Proximity based Hand Gesture Home Automation works on the principle of movements of hand. The system tracks the movement of hand from top to bottom, right to left, far and near or vice versa. Arduino UNO is connected with APDS-9960 which catches the movements of the hands and switches on and off the appliances. The APDS-9960 is a five pin gesture sensors that has VIN, GND, SCL, SDA and INT. The VIN and GND are for Voltage Input and Ground for the APDS. The SCL pin is for clock time and SDA is for data input. The INT pin is used to create interrupt between every gestures. The APDS-9960 requires 5V DC supply. Arduino UNO gets input from the gesture sensor. The Movement of the hand is taken in as an input and converted into text. The text is matched and appliances is switched on/off. In case of an invalid gesture the, “gesture unavailable” message appears. In this system right to left movement of hand switches on the fan and left to right switches off. The Movement top to bottom switches on the LED and bottom to top switches off the LED. The fan is connected with a 5V DC relay that works as a magnetic switch and controls switching on/off of the fan.



#### 4. FLOW DIAGRAM.

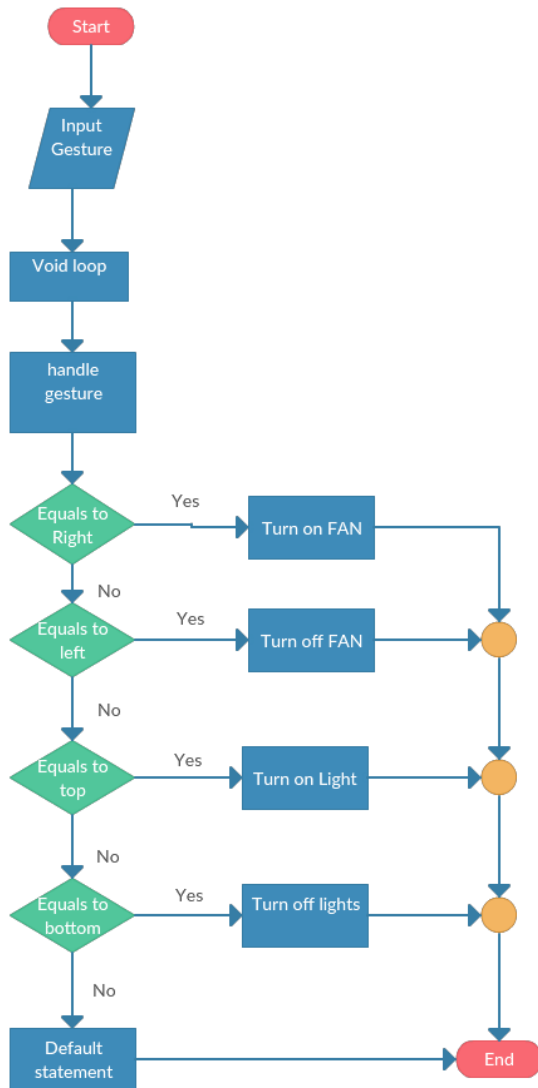


Figure 4.0 Flow Diagram of Hand Gesture Based Home Automation System

#### 5. COMPARISON BETWEEN CURRENT AND PROPOSED SYSTEM.

Table 1. Comparison of different Proposed System

Methodologies	Cost	Hardware Efficiency	Real time Application
Bluetooth	Low	Less Efficient compared to Wi-Fi	Easy
Wi-Fi	High	Efficient	Easy
Voice recognition	High	Less Efficient	Difficult
Gesture based	Low	Efficient	Easy

#### 6. CONCLUSION.

The methodologies above are compared on the basis of cost, Hardware Efficiency, and Real-time application. Comparing Bluetooth, Wi-Fi and Voice Recognition, Bluetooth is cost-efficient and easy to implement but hardware efficiency is low as the range of Bluetooth is 10-100 meters. Wi-Fi is costly compared to other methodologies as Internet connection and high-end devices are required. It is easy to implement but requires constant attention. Voice-based is costly, Hardware efficiency is low and Real-time application is difficult. Gesture-based is Easy to implement Requires less cost and Hardware efficiency is high. To concede, Hand Gesture-based Home Automation is one of the most effective solutions for home automation systems and also opens the gates for automation in different fields.

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