

# Arduino Based Speech Recognition System To Control Appliances

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## ABSTRACT:

Automation is a trending topic in the 21st century making it play an important role in our daily lives. The main attraction of any automated system is reducing human labour, effort, time and errors due to human negligence. With the development of modern technology, smart phones have become a necessity for every person on this planet. Applications are being developed on Android systems that are useful to us in various ways. Another upcoming technology is natural language processing which enables us to command and control things with our voice. Combining all of these, our paper presents a micro controller based voice controlled home automation system using smartphones. Such a system will enable users to have control over every appliance in his/her home with their voice. All that the user needs is an Android smartphone, which is present in almost everybody's hand nowadays, and a control circuit. The control circuit consists of an Arduino Uno microcontroller, which processes the user commands and controls the switching of devices. The connection between the microcontroller and the smartphone is established via Bluetooth, a widespread wireless technology used for sharing data.

**Index Terms:** Arduino Uno, HC-05 Bluetooth Module, Home Automation, Smartphone, Voice Control.

## I. INTRODUCTION

The ratio of population has increased with increasing living standards. Home Automation plays an important role in maintaining these living standards of population by providing a secure and flexible environment. The home automation system not only maintains the living standards but also helps an elderly and disabled people to live their life in convenient way. The continuous

growth of mobile devices and its functionalities demand for advanced mobile applications in people's daily lives is continuously increasing. The advancements lead to anyone, anytime, anywhere (AAA) Connectivity for things with the expectation advanced dynamic network [1][2]. Our home automation system is based on handheld devices equipped with android app. This can accept voice as well as direct commands and process them [3]. In order to maintain a natural medium of communication, the house employs speech recognition system capable of analyzing spoken language, and extracting commands from it. The device provides the features as switching devices ON/OFF. In home automation the voice processing has increased significantly in recent years. With that the user can communicate with electrical appliances rather than interacting directly with devices. The performance of the home automation can be increased by avoiding signal distortion. The home automation cannot be able to switch ON/OFF if the speech recognition is poor. The voice commands such as Light ON/OFF with some noises will be taken as an input. It sends to a speech recognition machine (SVM classifier). It makes a context search with existing database for an nearest keyword. If the keyword (Light ON/OFF) is present mapping is done and an action is performed

One of the early experimental works on the ZigBee based home automation system was presented in [6]. This system was capable of monitoring door and window, smoke, gas leak, and water flooding in a home from remote location. Some simple control systems such as operating a valve and sending signal to security network have also been associated with this application. A ZigBee based home network system to track a user has been proposed in [7]. This system periodically tracks a user by using three systems namely Indoor Positioning System (IPS-M), Indoor Positioning System Infrastructure (IPS-M), and Indoor Positioning System Gateway (IPS-G). In ZigBee based wireless home automation system a gateway is an important

component. One of such gateway architecture has been proposed in [8] to interconnect Digital Living Network Alliance (DLNA) compliant home appliances and a ZigBee network. In a similar work [9], another type of gateway architecture has been proposed to connect a low-rate home work with the internet. A user can control the home appliances via internet from a remote location through this gateway. A ZigBee based power monitoring system (PMS) has been proposed in [10]. In addition to ZigBee wireless communication the PMS also utilizes Digital Signal Processing (DSP) and Web services. Voice control system for ZigBee based home automation has been introduced. Speaker independent automatic speech recognition technique has been used. A number of modes have been used for convenience namely button trigger mode, voice password trigger mode, and circle recognition mode. A user can use any of the modes depending upon the conditions. A low power voice control system for home automation system has been proposed. In this system ZigBee network receives voice command as input to an ARM9 controller, which converts the data into a required format to be used in the microcontroller. Finally, the system generates some control characters to switch ON/OFF the home appliances. A client server based voice control system for home automation has been presented. Voice command is captured by a client.

## II. PROPOSED FRAMEWORK

The Voice-operated Android and Arduino Home automation system uses an Android based Bluetooth enabled phone for its application and the Arduino Uno as the microcontroller. The key components of this system are:

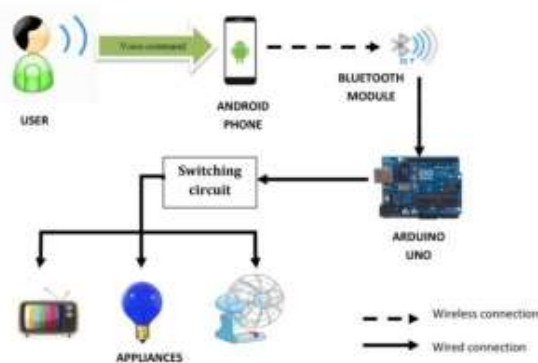


Fig.1 Hardware Block diagram of system

The proposed method which uses the low cost home automation systems which controls the devices remotely by using keyword matching which is shown in Fig.2. The home environment can be controlled and monitored using an android app which will communicate to the receiving node through bluetooth. The proposed system offers the control of lighting, DC motor, and fan.

### A. Arduino ATmega328

The Arduino Uno is a microcontroller board based on the ATmega328. It has a 16 MHz ceramic resonator, 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a USB connection, a power jack, an ICSP header, and a reset button. This board is very simple and can be easily used, everything you need to support the microcontroller is in this board, just plug it in a computer via USB cable and power using an AC-to-DC adapter or battery to get started.

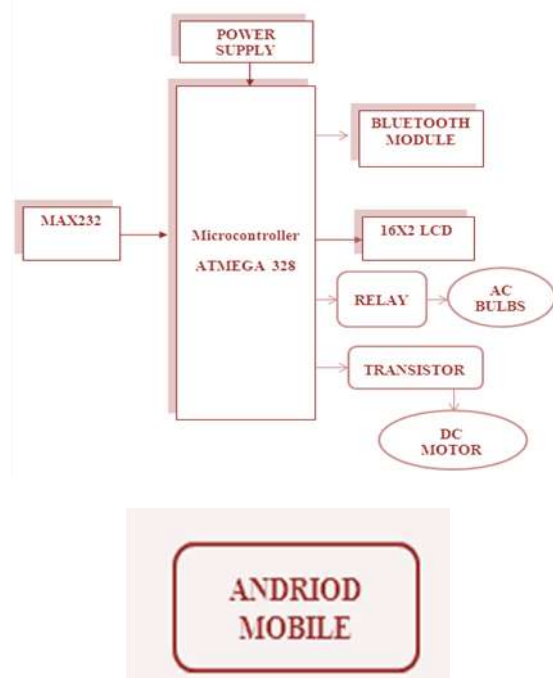


Fig.2 Block diagram of functional unit

### B. Android Platform

Android devices are powerful mobile computers and they become more and more popular smart phones used worldwide. They become more and more popular for software developers because of its powerful capabilities and open architecture, also it's based on the java programming language. For the communication of the receiving node with the mobile we are using the

Bluetooth device. The Bluetooth device (HC-05) is attached to the node that receives the data from the mobile and also can transmit the data.

**1. Keyword Matching:** Keyword matching makes a context search with existing database for a nearest keyword. If a keyword is matched the action is performed.

**2. Speech Recognition:** A speech recognition program process voice commands by using an Android SDK and the processed voice command will then send to a CSP

**3. Control signal program:** Control signal program send a command to a microcontroller with its address and Command in bytes.

The system is further simplified by allowing appliances to be controlled by our voice. The user need not have to have immense knowledge over the language of English. Just by saying the appliance name and the corresponding number assigned to that particular appliance, and telling it to switch on or off will enable the user to have complete control over any appliance without any effort.

### III. RESULTS AND DISCUSSIONS

Using the above mentioned components we implement our system on a breadboard. The microcontroller device with the Bluetooth module and relay circuit needs to be attached with the switch board. Then we need to launch the android based application-“AutoHome” on our Smartphone. Through the application we can instruct the microcontroller to switch on/off an appliance. After getting the instruction through the Bluetooth module the microcontroller gives the signal to the relay board. The application first searches for the Bluetooth device. If it is available then it launches the voice recognizer. It reads the voice and converts the audio signal into a string. It produces a value for each appliance which will be given to the microcontroller device. The microcontroller uses the port in serial mode. After reading the data it decodes the input value and sends a signal to the parallel port through which the relay circuit will be activated. Some images to illustrate the working of the system have been given below.



Fig.3 Application connecting to the Bluetooth device

The Bluetooth module transmits the text to the Arduino Uno serial port. The text is matched against the various combinations of predefined texts to switch the appliances on/off. The appliance name and a command for on/off are stored as predefined command. For example, to switch on a television the user needs to say “bulb on” and to switch it off he needs to say “bulb off”. The appliances are connected via the relay boards to pin numbers 2, 3 and 4 of the Arduino Uno. When the matching text is detected the corresponding pin number is given a high or low output signal to switch the appliance on and off respectively.



Fig.4 Turning ON Light 1

### IV. CONCLUSION

The proposed project undertakes a viable solution the need of automation at the very basic level, that is, in our homes. The project will enable us to bring every appliance at every corner of our home under our control from a single point without having to get up and manually switch on or off the appliance. The use of a Bluetooth module assist the use of this system from

various locations in our house. Android applications are very simple and user friendly allowing the user to understand its functionalities in very little time. Hence, the use of android application in this system allows a user to easily learn the process and get accustomed to the functions. This system, though primarily aimed to reduce human effort, will be of much importance to old aged people and physically handicapped people.

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