International Scientific Journal of Engineering and Management ISSN: 2583-6129
Volume: 03 Issue: 03 | March – 2024 DOI: www.isjem.com
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

# "Voice activated lamp using Arduino''

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**Abstract -** In the realm of smart home automation, this project introduces a Voice-Controlled Lamp System utilizing Arduino Nano, a Bluetooth module, and a single-channel relay. The system enables remote lamp control through a dedicated mobile application, leveraging natural language voice commands for intuitive interaction. By integrating cutting-edge hardware and software components, the project aims to enhance user experience, convenience, and accessibility in home environments. Through rigorous testing and validation, the Voice-Controlled Lamp System demonstrates the potential of Arduino-based solutions in crafting user-friendly and efficient smart devices, contributing to the evolution of modern home automation technologies.

This project presents the development of a Voice-Controlled Lamp System, utilizing Arduino Nano, a Bluetooth module, and a single-channel relay. The system offers users the ability to remotely control the lamp through a mobile application, employing natural language voice commands for seamless interaction. By integrating state-of-the-art hardware and software components, the project addresses the growing demand for intuitive and hands-free home automation solutions. Through extensive testing and validation, the Voice-Controlled Lamp System showcases the efficacy of Arduino-based technologies in creating innovative and user-centric devices for modern living environments.

## 1.INTRODUCTION

In the era of burgeoning smart home technologies, the quest for seamless integration and intuitive control mechanisms has become paramount. This project endeavors to contribute to this narrative by presenting a Voice-Controlled Lamp System, leveraging the capabilities of Arduino Nano, a Bluetooth module, and a single-channel relay. The project aims to revolutionize traditional lamp control paradigms by offering users the ability to remotely and effortlessly operate the lamp through a dedicated mobile application, utilizing natural language voice commands.

The motivation behind this project stems from the inherent desire to enhance user experience and accessibility within the realm of home automation. As the proliferation of smart devices continues unabated, there is a growing need for intuitive and hands-free control mechanisms that seamlessly integrate into the daily lives of users. Voice control emerges as a promising solution, aligning with the natural human inclination towards verbal communication and simplifying the interaction process. At the heart of the Voice-Controlled Lamp System lies the Arduino Nano, a versatile microcontroller renowned for its flexibility and adaptability. Acting as the brain of the system, the Arduino Nano orchestrates the intricate interplay between hardware components, facilitating wireless communication with a mobile device via a Bluetooth module. This wireless connectivity eliminates the constraints imposed by physical interfaces, empowering users to control the lamp from anywhere within the vicinity.

Critical to the functionality of the system is the single-channel relay, which serves as the intermediary between the digital realm of programming and the physical domain of the lamp. By translating digital signals into tangible actions, the relay enables the execution of user commands, seamlessly toggling the lamp on or off in response to voice prompts.

People's increasing demand for living conditions has catalyzed the emergence of smart homes. Smart homes realize the interconnection of smart devices in the home, register each device on the cloud, and implement remote control through mobile terminals. From a technical point of view, from the development to the present, the smart home has gone through three stages. At the beginning, the device was connected to a smart home system through the home bus technology to complete the control. The wired access method made the installation and maintenance of the smart home become cumbersome. Compared with the former, this method has become more mature and more convenient to use, but it is still in the stage of "weak intelligence" and cannot meet the needs of intelligence and humanization. In recent years, related technologies have made huge breakthroughs, which have rapidly improved the accuracy of speech recognition . Using voice recognition technology in smart homes, people can communicate and control in natural language with devices, which greatly improves experience and meets people's consumer needs. From this perspective, using voice recognition in smart homes has a very broad prospect.

Smart home is based on the residential environment, using wireless network technology, automated control, and voice recognition technology to integrate home appliances and facilities to establish an efficient home management system to enhance the convenience and comfort of home life . Smart home connects various household facilities into a wireless network and provides multiple functions such as home appliance control, lighting control, and indoor and outdoor remote control. Smart home not only has the functions of traditional home but also has the characteristics of automatic and intelligent and can even save energy and money. With the

 

ISSN: 2583-6129
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advent of the information technology era, computers have become more and more indispensable daily tools for people, and language is the most direct way of expressing human thoughts, opinions, and emotions. As a human voice interaction object, let it have the same ability to understand words as humans, which will make a huge change in people's lives and working methods, and a voice human-computer interaction system based on voice recognition technology will emerge as the times require.

## 2. Body of Paper

The purpose of smart home is to provide users with a comfortable, safe, and convenient home life experience and overcome the shortcomings of traditional electrical control solutions.

Traditional home appliance control has disadvantages such as cumbersome wiring, difficult maintenance, poor scalability, and high cost. At the same time, there are problems such as aging wiring that threaten the safety of family property. The traditional electric appliance control usually adopts the push switch to control the electric appliance. Generally, the long distance between the electric appliance and the control switch requires complicated wiring, which is inconvenient to control and poor in scalability. Compared with the traditional electrical control scheme, ZigBee wireless communication is adopted between the remote control and the receiving end in this design. The system is highly integrated, and the remote control can be controlled by "one-to-many" and "many-to-one" by programming related programs. This article introduces the software design part of the smart home control system based on speech recognition technology. First, according to the function of the system, the overall design of the system software and the wireless communication method among the client, server, and controller are introduced. Secondly, it introduces the construction of the software development environment. Then, a radio frequency communication protocol was designed to make multimode control more convenient. Finally, it focuses on the software design of the main control center, control node, and intelligent terminal. In this paper, the research and design of the smart home embedded control system based on voice perception conducts an experimental test. A corpus was constructed, and experimental tests were carried out on each module. The system has been functionally tested, and the results show that the system can realize the functions of audio collection, family member confirmation, wireless control, voice command recognition.

**Table- 1identify rate of voice acceptance**

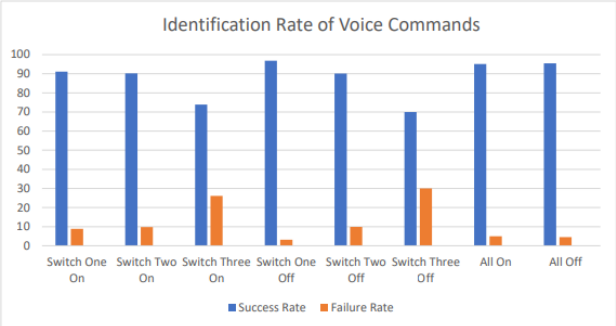


*Figure 27-Identification rate of voice commands after the changes*

**Costing**

| SR.NO | Material | Amount |
|---|---|---|
| 1 | Arduino nano | 300 ₹ |
| 2 | Bluetooth module | 245 ₹ |
| 3 | Single channel relay module | 200 ₹ |
| 4 | Lamp- | 250 ₹ |
| 5 | Jumper Wires | 90 ₹ |
| 6 | Lamp Holder | 80 ₹ |
| 7 | Adapter | 200 ₹ |
| 8 | Arduino Nano USB Cable | 70 ₹ |
| 9 | Connecting wires | 100 ₹ |
| 10 | MDF Board | 100 ₹ |
| Total | | 1635 ₹ |

1. Remote Control:- Users can remotely control the lamp from their mobile devices using the dedicated application. They can turn the lamp on or off by simply speaking voice commands into their device.

2.Intuitive Interaction:- The system provides an intuitive and user-friendly interface,where users can communicate with the lamp using natural language voice commands,enhancing accessibility and convenience.

3.Wireless Connectivity:- The system utilizes Bluetooth technology to establish a wireless connection between the mobile application and the Arduino Nano, enabling seamless communication and control.

4.Reliable Operation:- Through rigorous testing and validation, the system ensures reliable operation, accurately interpreting and executing voice commands to control the lamp's state.

5. Energy Efficiency:- By enabling users to control the lamp remotely, the system promotes energy efficiency by allowing them to turn off the lamp when not in use, thereby reducing unnecessary power consumption.

6. Demonstration of Concept:- The completed project serves as a tangible demonstration of the concept of voice-controlled home automation, showcasing the feasibility and practicality of integrating Arduino-based hardware and software components for intuitive device control.

 

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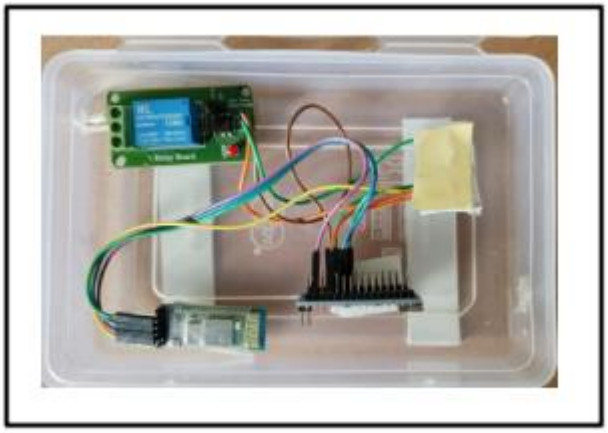

**Fig -1**: Figure shows hardware model of project

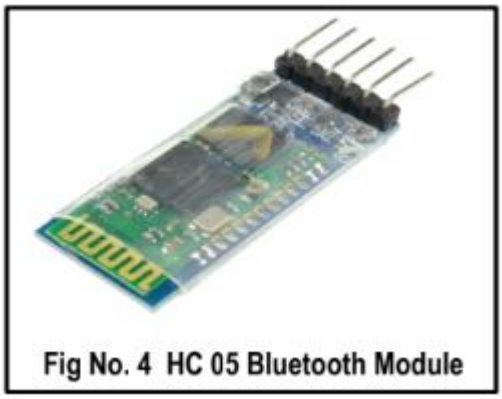

Fig No. 4 HC 05 Bluetooth Module

**Block diagram :**

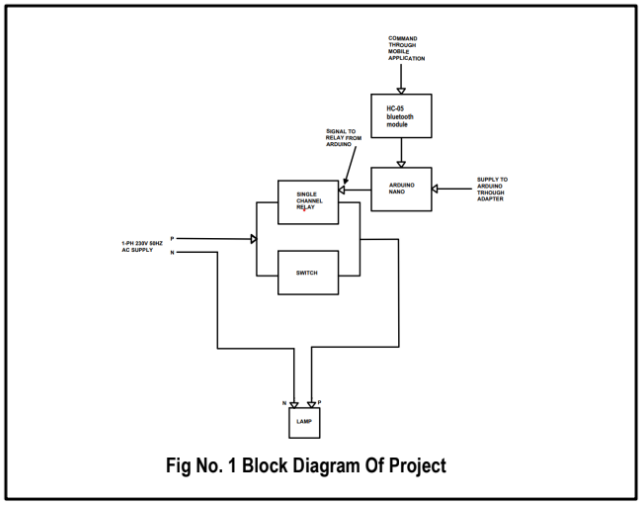


Fig No. 1 Block Diagram Of Project

**Block Diagram Description:**

Following are the important blocks of this system

1) Arduino nano :-

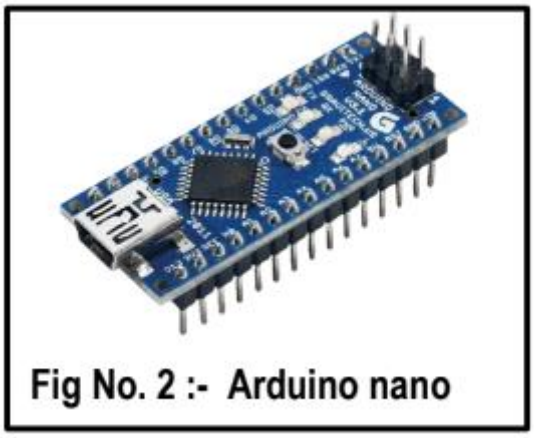

Fig No. 2 :- Arduino nano

The Arduino Nano was first released in 2008 and is still one of the most popular Arduino boards available. The Nano is a breadboard-friendly board, based on the AT mega 328 8-bit microcontroller by Atmel (Microchip Technology). It has more or less the same functionality as the Arduino Uno but in a smaller form factor. The only thing that is missing is a DC power jack and it works with a Mini-B USB cable instead of a standard one. The Arduino Nano has a compact size and mini USB cable than the Arduino UNO. We can use Nano instead of UNO because both operate on the microcontroller ATmega328p.The Arduino UNO is also easily available than Nano. It is considered as the standard board available in the market, which is easy for use for the starters or beginners.The Nano is available in PDIP (Plastic Dual - Inline Package), while Arduino UNO is available in TQFP (Plastic Quad Flat Pack). The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. The Arduino Nano includes an I/O pin set of 14 digital pins and 8 analog pins. It also includes 6 Power pins and 2 Reset pins

## 2) Single channel relay module:

Fig No. 3 single channel Relay

The single-channel relay module is much more than just a plain relay, it contains components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active.

First is the screw terminal block. This is the part of the module that is in contact with mains so a reliable connection is needed. Adding screw terminals makes it easier to connect thick mains cables, which might be difficult to solder directly. The three connections on the

terminal block are connected to the normally open, normally closed, and common terminals of the relay.
The second is the relay itself, which, in this case, is a blue plastic case. Lots of information can be gleaned from the markings on the relay itself. The part number of the relay on the bottom says “05VDC”, which means that the relay coil is activated at 5V minimum – any voltage lower than this will not be able to reliably close the contacts of the relay. There are also voltage and current markings, which represent the maximum voltage and current, the relay can switch. For example, the top left marking says “10A 250VAC”, which means the relay can switch a maximum load of 10A when connected to a 250V mains circuit. The bottom left rating says “10A 30VDC”, meaning the relay can switch a maximum current of 10A DC before the contacts get damaged. The 'relay status LED' turns on whenever the relay is active and provides an indication of current flowing through the relay coil. The input jumper is used to supply power to the relay coil and LEDs. The jumper also has the input pin, which when pulled high activates the relay. The switching transistor takes an input that cannot supply enough current to directly drive the relay coil and amplifies it using the supply voltage to drive the relay coil. This way, the input can be driven from a microcontroller or sensor output. The freewheeling diode prevents voltage spikes when the relay is switched
off.

**3) HC-05 Bluetooth module**

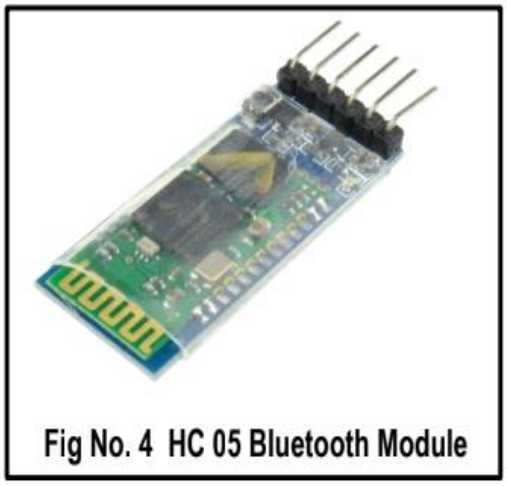

Fig No. 4 HC 05 Bluetooth Module

The HC-05 is a popular module which can add two-way (full-duplex) wireless functionality to your projects. You can use this module to communicate between two microcontrollers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop.
There are many android applications that are already available which makes this process a lot easier. The module communicates with the help of USART at 9600 baud rate hence it is easy to interface with any microcontroller that supports USART. We can also configure the default values of the module by using the command mode. So if you looking for a Wireless module that could transfer data from your computer or mobile phone to microcontroller or vice versa then this module might be the right choice for you. However, do not expect this module to transfer multimedia like photos or songs; you might have to look into the CSR8645 module for that.

## 4) Mobile Application

A application named Arduino Bluetooth controller is used to operate the project by connecting the device with the Arduino via Blueooth.The user can also operate the lamp by button on the application and also by typing the command in the chat box provided by the application Adding Bluetooth to your Arduino is the simplest way to give your Arduino projects the power of wireless possibilities.
You can get rid of messy wires between the Arduino and the moisture sensor, or even better, you can read the moisture value on your phone directly. You can control a remote car, a toy crane, or a robotic arm using your mobile with a Bluetooth module and Arduino.
You will be able to create interesting Bluetooth wireless projects by the end of this tutorial.HC- 05 Module is a versatile, low-cost, and very easy-to-use device. I will show you how to use the HC-05 Bluetooth module with Arduino. I have given all the critical information about HC- 05, such as pin details, voltage, current specifications, communication protocol information, etc.I will give you working project examples with connection diagrams and code for HC-05
projects, which you can use straight away.

## 3. CONCLUSIONS

In conclusion, the development and implementation of the Voice-Controlled Lamp System
represent a significant milestone in the realm of smart home automation. By leveraging
Arduino Nano, Bluetooth technology, and a single-channel relay, the project has successfully
demonstrated the feasibility of intuitive and hands-free lamp control through natural language
voice commands.
Through meticulous hardware integration and software programming, the system offers users
a seamless and convenient means of remotely controlling the lamp from their mobile devices.
The intuitive user interface, facilitated by a dedicated mobile application, enhances
accessibility and usability, catering to the modern user's preferences for effortless interaction
with smart devices.
The project underscores the potential of Arduino-based solutions in democratizing access to
home automation technologies, empowering enthusiasts and hobbyists to create custom
solutions tailored to their specific needs. Furthermore, the integration of voice control adds a
layer of sophistication and modernity to the system, aligning with current trends in natural
language interaction and user-centric design.
Moving forward, the project opens up avenues for further exploration and refinement, including the integration of additional features and functionalities, optimization of energy efficiency, and expansion to other home appliances. By continuing to innovate and iterate upon the foundation laid by the Voice-Controlled Lamp System, we can contribute to the ongoing evolution of smart home technologies and enrich the lives of users through enhanced convenience, accessibility, and interconnectedness.

ISSN: 2583-6129
www.isjem.com

## ACKNOWLEDGEMENT

I express my deep sense of admiration and gratitude to project guide Prof. Sumit Thakre Lecturer, Department of Electrical Engineering, Zeal Polytechnic, Narhe, Pune, for him invaluable encouragement, helpful suggestions and supervision throughout the course of this work. His willingness, patience and optimistic attitude could lead to completion of this project work. I am also thankful to for moral support Prof. Ramesh Mandale.
I also express my thankfulness to the encouragement from Prof. Tamboli A.A (Principal, Zeal Polytechnic, Narhe,(Pune), Prof. Ramesh Mandale (HoD) Department of Electrical Engineering) and all faculty members of Department of Electrical Engineering, Zeal Polytechnic, Narhe, Pune, for their valuable suggestions from time to time..

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