

Home Automation Application with voice commands using Arduino

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Abstract- Since the utilization of energy is expanding step by step, there is an extraordinary need to stop the abuse of energy altogether. Home automation is one of the best ways of the utilization of this innovation everybody can improve their lifestyle at the homes, it erases human endeavors and stress, energy efficient in this way make a smart home. This home mechanization or innovation progress is mind blowing in previous time and in the future too it will develop dramatically as their necessities, prerequisites, and advantages. Everybody wants to save their time and energy alongside this there are likewise incapacitated individuals in houses and they can't move regularly in the home for controlling machines, so utilizing a home automation framework empowers those all individuals to control all the apparatuses effectively and with ease. This paper gives the pragmatic methodology and execution of a dependable, effectively open, reasonable, minimized and modest. Home automation framework that depends on an android phone, home appliances can be controlled with simply a single touch on the android portable application.

Key Words: Automation framework, Arduino NANO, Android Mobile Application Controlled framework, Bluetooth HC-05 controlled, programmable mechanization

1. INTRODUCTION

Automation Technology has numerous uses, advantages, and applications in every field of life such as industrial automation, Lighting control, Aircraft automation, automatic vehicles, Appliance control and integration, Security and tracking automation technology. The consumptions of energy at homes tend to increase in proportion with an increase of heavy home appliances like air conditioning, refrigerators and heater. Home automation can give more quality and ease of life for everyone. Home automation technology becomes an energy consumption controller and an easily accessible smart home technique. . The system designed is a combination of smartphones and an embedded system that consists Arduino Module, a Bluetooth device, and a Relay module. This research provides a cheaper, efficient, effective, and user-friendly interface easily accessible system of home automation. The system can be easily updated with just simple changes that ensures reliability. . In general, home electrical appliances still using the simple man-handling control system, this problem can be overcome by the development of automatic and programmable control system. This research gives a new system of home automation based on Arduino using Bluetooth wireless communication. This Simple Arduino based system is cost efficient, gives accurate working, and gives users to control all electrical types of equipment through a Smartphone Application with just a click. The system provides an easy interface for the user to operate all home appliances with an application or programmable control. Through the mobile application, one can send signals of on/off easily. One can send signals in both modes switch as well as voice commands. The ever developing technology in home automation is becoming more popular day by day as per the increase in demand and requirement.

1.1 System Description

The system used in this home automation is as follow;

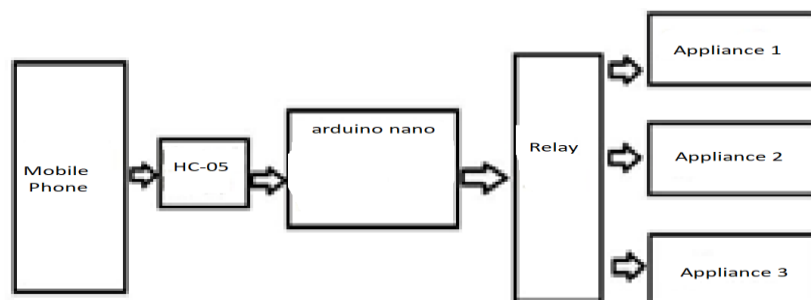
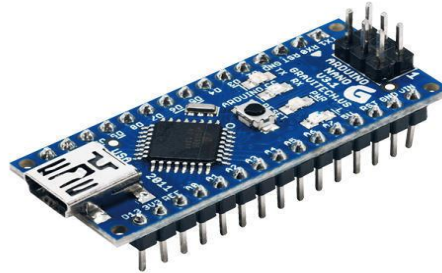


Figure 1. Block diagram

As we see from the diagram the Arduino plays the main function of microcontroller in the system. Arduino controls the mobile app and Bluetooth module. The Arduino NANO hosts the C++ programming Scripts which provides the user to access all home appliances. The programming script is the core of this system which carries a key role in processing all instructions with the Arduino NANO module. An ad-hoc communication protocol is set up between two devices, which allow controlling the behavior of the Arduino and BT board/module. Wireless serial communication is supported by the Arduino NANO over Bluetooth [5]. Overall this home automation system consists of the following major parts:

A. ARDUINO NANO



The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

B. BLUETOOTH (HC-05) MODULE



Bluetooth (HC-05) Module The medium between the system and the Android mobile app for communication is the Bluetooth. It plays the role of the wireless medium in the system. This connects the Arduino signal to the mobile app as Arduino has programming within it. It works within a limited range, but its ranges can be increased.

C. RELAY MODULE



Relay Module As the block diagram shows the AC supply of all appliances is across the relay module with acts as an electrically operated switch.

D. ANDROID MOBILE APP

A mobile app is used to operate all appliances. In the app, just simple touch can turn to switch off/on your all appliance from anywhere in the home.

1.2 SIMULATION METHODOLOGY

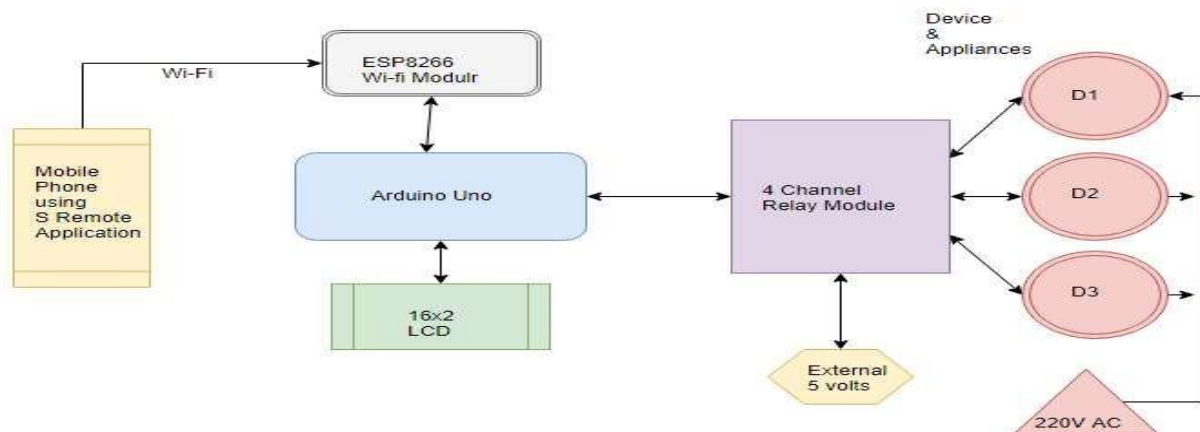


Figure 2. Simulation methodology

In simulation design, all the major components are placed so that the working and processing of the system can be observed before implementing the hardware. The result of the simulation design was up to the mark that system works with high accuracy and high execution speed. The Arduino IDE can easily be downloaded from the official website of the Arduino. Arduino as a microcontroller which is connected with Bluetooth module HC-05 for wireless communication. Arduino is also connected to the loads with help of relay module system has a four- channel relay module and all the loads are parallel connected. After all the connections the process of the simulation was executed and finally observed that the system id working accurately and correctly without any errors. The android application receives command in two ways firstly clicking the button and secondly voice command. These commands are carried by the Bluetooth module toward the Arduino for further processing.

2. HARDWARE DESIGN

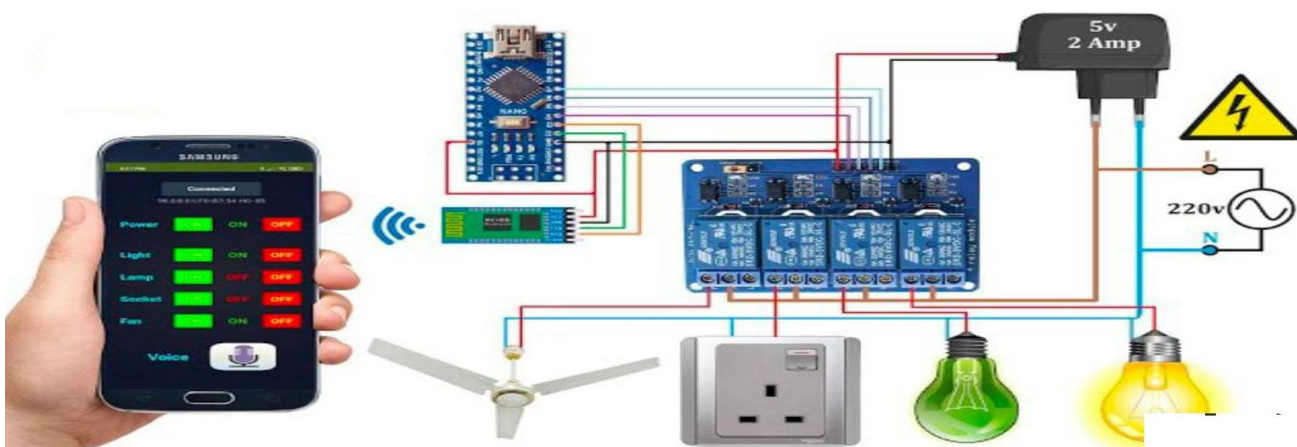


Figure 3. Hardware Design

In a hardware implementation, Arduino NANO is placed as a microcontroller to control the hardware. On the Nano board, 22 pins are associated with input and output. In that 14 pins (D0 to D13) are true digital IO pins, which can be configured as per

you application using pinMode(), digitalWrite() and digitalRead() functions. [6]. Arduino does not carry any wireless connection within it that is why we use Bluetooth module Hc-05 for wireless communication. Bluetooth device is used for communication between Smartphone application and Arduino NANO. The relay Module is controlled by the Arduino which receives the command from the Smartphone application and processes the received command. The relay Module is used as electrical switches in the system. Our system has four relay channels for different loads. The design of the hardware of our sampled home automation system is as follows:

Hardware design Hardware implementation consists of the following:

- Arduino NANO
- Bluetooth Module HC-05
- 4Channel Relay Module (9V)
- Power supply, Loads(watt savers) and connection wires, etc
- 9v Battery or 9v adapter
- Jumper wires

MATHEMATICAL DESIGN

Set theory was used in this system for the mathematical representation [1]. Let suppose the system is $S = \{O, I, U, E, S, \text{send } [], \text{Received } []\}$ Here;

S = Starting state of the system. I= Input command for the system. O= {01, 02, 03, 04}, 01= Operation for load one 02= Operation for load two 03= Operation for load three 04= Operation for load four Send [] = It is a command sending function to Arduino. For example, Input command Send [I] Receive [] = It is the command receiving function from the mobile app for example: Receiving the command Receive [I].

E = State's End [1].[1]

I. SOFTWARE DESIGN

The software part of the system is programming on Arduino NANO and second is the designing of the android mobile telephone operation for the system. The software which was used in this system for making come into existence the telephone operation was Mit telephone operation inventor [1].

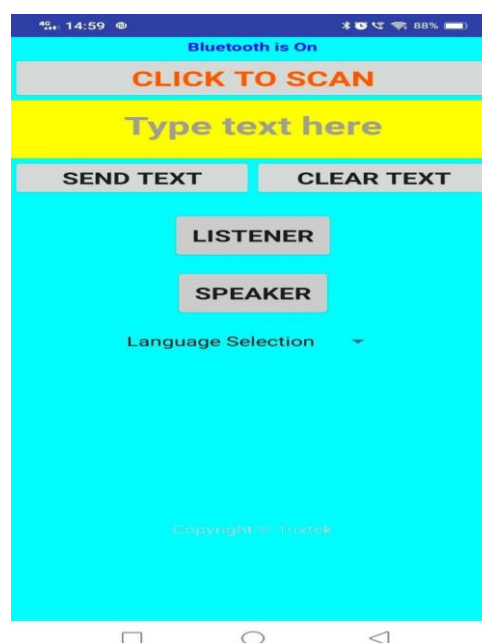


Figure 4 . App Design

II. CODES OF ARDUINO NANO

The programming of the Arduino which act as the microcontroller is the heart of the system which plays a vital part to act the system accurately and with small amount of support. codes of the Arduino are only designed at C ++ language and which need the system according to the user teaching [8]. These codes are only designed for this sample starting place automation system. These codes have particularly used pins in the Arduino which the only be used for this type of sample system. The hardware of the system is designed according to these codes. Here is the link of the codes used in this sample system [8].

III. EXPERIMENT TEST

Based on the operation of making observations and work guided, attempt to look at the outcome of the system.

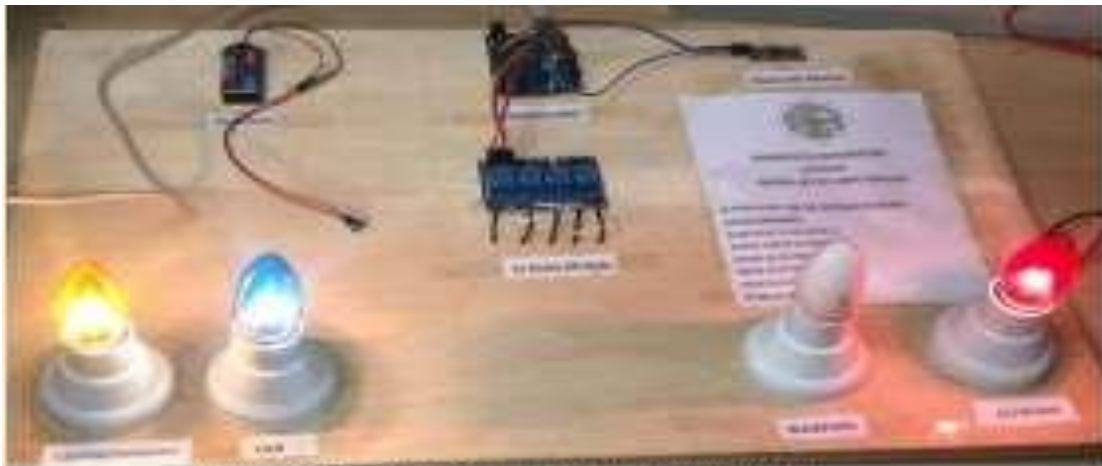


Figure 5. Design of sample home automation

At an early age, the home appliances business managers were such as controlled by hand like to turn on/off the appliances one has to go to the switchboard. It is good for normal people but an old age person and the physically put out of normal operation person cannot way in it. So, the system enables to control of all starting place appliances from a far away, widely different area in now. Now we can operate our starting place appliances from anywhere in the home but within the range of the Bluetooth part of a greater unit. This way in gives a chance to make seem unimportant the using up of energy, user 7's time, and take in for all to operate electrical appliances. This system is very simple, not hard to use and it is especially selected for people without a technical back knowledge. It is very simple, not hard to use the home automation system which makes user friendly and act of making regular to support. This system is much better for scalability and able to make ready adjustments than the by business available starting place automation systems.

The system is very simple in the putting into effect and also for the user 7's point of view. The complex part of the system is very low so that all non-technical people do not discover it hard to use the technology. For the hardware simplicity, short sending word Service with low price for take-back and control from any phone to move up and down the switch state. The processing time of the need is very low which shows high efficiency. The working efficiency of the system is very high because the need as per given by the user is accurately done by the system. In the putting into effect of the system, it is very carefully observed the efficiency of the system that when the need is given for the LOAD 1 then it is only processed for load 1 and given accurate results with 100% efficiency. In the putting into effect, the microcontroller says without any doubt the system with high accuracy in the working process. Bluetooth part of a greater unit with a limited range makes certain the high execution speed of the system. relay part of a greater unit with load connections gives electrical open switch and safety in the form of any fault.

IV. RESULT AND DISCUSSION

Load	Initial State	Input Signal From App	Output Result
LED 1	Off	On	On
LED 2	On	Off	Off
LED 3	On	No Signal	Same state
LED 4	Off	On	On

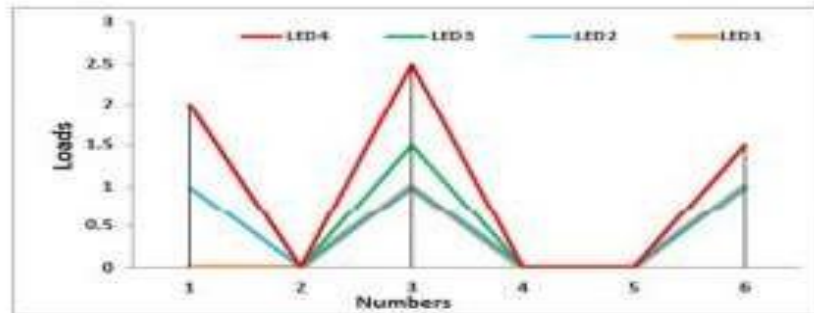


Figure 6. shows the graph of the obtained results.

This system has many advantages over other family living place automation systems that are its low price and user-friendly interface, another is the no being complex of the system. This system has a range limit because of, in relation to the use of a Bluetooth part of a greater unit which makes it safer and more comfortable for the user to way in the system. Many other well-dressed starting place automation technologies has complex conditions and they are very high priced, of great value thus system came up with new technology so that all people can make automatic their works or duties. In this system, instead of using advanced 7 technologies such as wi-fi, IoT, and Cloud as a Bluetooth part of a greater unit is used for communication purpose and integrating all other apparatuses in wireless mode. Bluetooth technology makes certain the quicker data transfer and its processing's much quicker than other technology.

- When the user gives the command to the Smartphone app [6] the application gives the signal to the Bluetooth device which is directly connected with the Arduino board Smartphone app has all the GUI options for all appliances separately.
- After receiving the signal from the Smartphone application Bluetooth device send the signal to the Arduino board for further processing,
- The controller in this system is Arduino which controls all the appliances. Bluetooth devices and the Relay Module are connected to the Arduino NANO [4]. The Relay board command for the switching on/off the appliances is processed by Arduino NANO.
- The Relay board acts as the open switch, it operates on/off [3]. The Main supply of all home appliances is connected through the relay board.
- Main while user gives the command to Smartphone Application which is transferred to the Arduino through Bluetooth. Finally, Arduino controls all the appliances by processing the command and work relay accordingly.

CONCLUSION

This paper presents a cheap, secured, efficient, easily accessible, automatically controlled solution for the home appliances. This system has many features and its cost is also very low compared to all other systems. It provides smart work, energy consumption control, security, comfort, and ease at the same time. In this paper, the approach was novel and has achieved the desired target to control the appliances wirelessly. The system can be easily modified and upgraded with different features as per the need of the user.

This interface makes the system a perfect choice for both old and new houses. The future system would be modified to a system remotely via IoT technology and cloud. Wi-Fi technology can be a good replacement for Bluetooth technology to maximize the range and speed.[3] For the control and monitor virtually all the electrical devices GSM technology would be used easily in the system with a small modification. The system can be made advanced by using different sensors like light sensors (LDR), motion sensors (PIR sensor), and also various temperature sensors, based on the condition that provides toggling of devices

automatically. By using these all there would be more comfortable and energy saved i.e., turning off lights if not necessary and checking the brightness required by Light sensor and the motion sensor like PIR sensor can be used to turn off/on any electrical devices automatically and also can be used for the security. For the safety of homeowners and a greater control system, it can be easily integrated closely with the home.

The software app which is installed in the android mobile is modified by implementing other features such as speech recognition voice control and can be modified by fingerprint access to the app that makes the whole system more secure and advanced. The major modification step would extend the system to a large-scale environment like industries, factories, and offices.

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