

DESIGN AND CONSTRUCTION OF FOUR CHANNELS AUTOMATIC BLUETOOTH CONTROL SYSTEM

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Abstract

In this work, four channels automatic Bluetooth control system is designed and developed. The system consists of the regulated power supply, Bluetooth module, relay drivers and Arduino microcontroller uno board. An Arduino which is an open-source microcontroller board can be controlled or programmed by the computer. The Arduino programming language is used to program Arduino board through serial communication. The firmware program on the Arduino board is controlled by the android application program on the smart phone. Totally, four channels' appliances are controlled separately from the smart phone.

Keywords: Bluetooth control system, Arduino microcontroller, smart phone serial communication.

Introduction

Now a day, home and office appliance controlling are common things. For controlling appliances, machineries in companies and industries uses different types of automation systems. Automatic Bluetooth control system means that allow users to control electrical appliances of varying kind such as lighting control [Simon.M, (2010)]. An Arduino Uno is a single-board microcontroller board based on the ATmega328. "Uno" means one in Italian [John.B, (2013)]. The Arduino output has 3.3 V and 5 V supply. If supplied less than five volts, the board may be unstable. If using more than 12 V, the voltage regulator may overheat and damage the board. The recommended range is 7 V to 12 V. The pins labeled "GND" on the Arduino, these are ground pins. The labeled A0-A5 is the analog input pins. These pins are used to make analog measurements of sensors or other components [Floyd.T.L, (2006)] . Analog inputs are especially good for measuring things with a range of possible values [Charles Roth.H, J., & L.K.Larry, (2015)]. The component of Arduino board is shown in figure 1. It can be programmed from the Arduino development software [Harold.T, (2011)]. In this research work, Bluetooth module XM-15B SPP is connected with a microcontroller board to study the method of application of the wireless communication between Arduino via Bluetooth module and android smart phone. Bluetooth module is shown in figure 2.

Methodology of the System

Hardware Development of the System

Hardware of the constructed system mainly consists of three main sections. They are Arduino via Bluetooth module control section, relay driver circuit section and android smart phone control section. Block diagram of four channels automatic Bluetooth control system is shown in figure 3. Firstly, the Bluetooth module of TX pin and RX pin are connected to the Arduino uno board of digital I/O pin 10 and pin 11. The digital I/O pins 4, 5, 6 and 7 are output signals which are connected relay driver circuit to control AC main line. The circuit is controlled by android smart phone wirelessly through Bluetooth module. After the application is installed

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on android smart phone, it can be sent message as a single digit (or single alphabet) from a phone to the constructed circuit.

Software written using Arduino is called sketches. These sketches are written in the text editor. Sketches are saved with the file extension (.ino). Figure 4 is flowchart of application software for the system. Sketches are shown in figure 5. It has features for cutting/pasting and for searching & replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino environment including complete error messages and other information. The bottom right-hand corner of the window displays the current board and serial port. The toolbar buttons allow verifying and uploading programs, creating, opening, and saving sketches, and open the serial monitor.

Bluetooth Module

Bluetooth is a wireless technology standard that is used to exchange data over short distances using short-wavelength radio transmission. It was created by the telecom company Ericsson in 1994. Bluetooth operates at a range of 2400 - 2483.5 MHz as a packet-based protocol using master-slave structure and provides a secure way to connect and exchange information between devices. In this research, Bluetooth module is used XM-15B SPP (Serial Port Profile). It can be connected directly to a microcontroller board via two wires (TX and RX).

Operation of the System

The Bluetooth name is 'New Name' and default pairing code is 1234. The blue status LED on Bluetooth module switches from a blinking to steady on when it is connected. When the system components are constructed and requirements software are already installed, the four channels Bluetooth control system is implemented successfully. If the digital output signal from Arduino board is HIGH, the relay will convert from normally open to close condition of AC main line. If the digital output signal from Arduino board is LOW, the relay is steady open condition. The communication distance is under open conditions 30 m and the normal use of the environment around 15 m.



Figure 1: The components of Arduino uno board **Figure 2:** The component of Bluetooth module

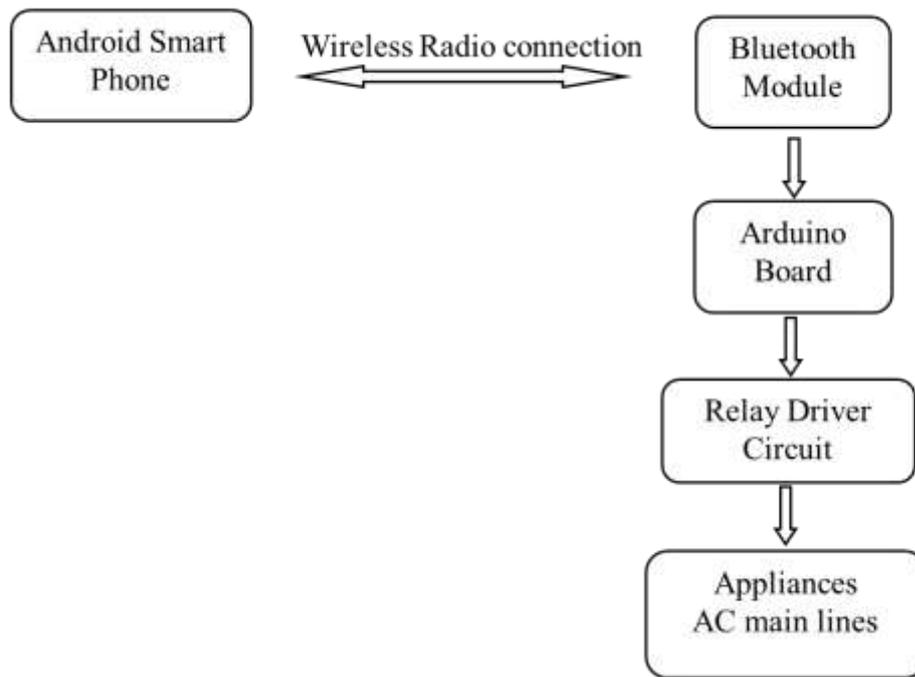


Figure 3: Block diagram of four channels automatic Bluetooth control system

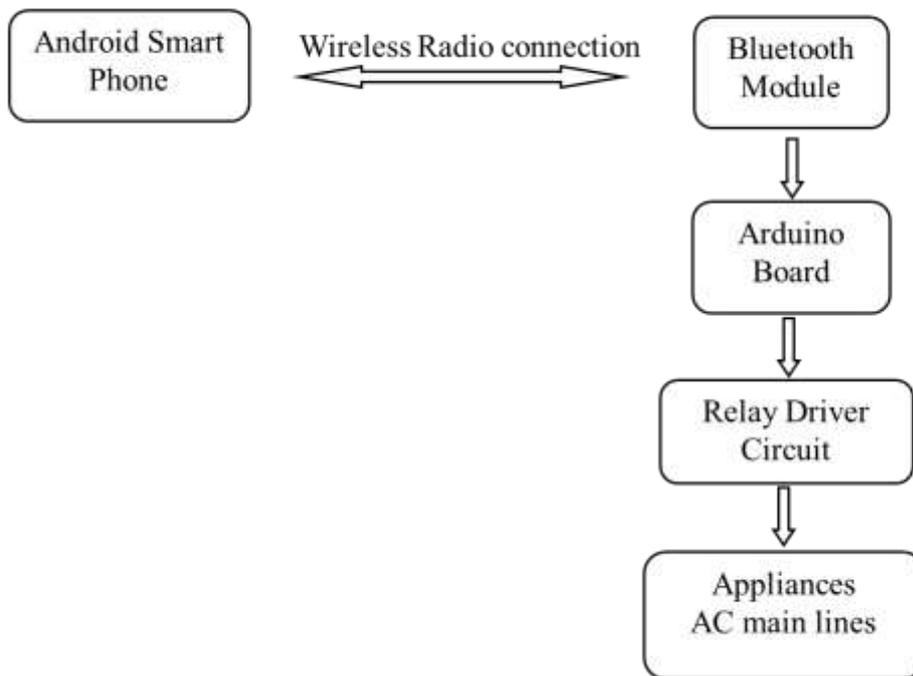


Figure 4: Flowchart of application software

```
FourChannels | Arduino 1.8.9
File Edit Sketch Tools Help
FourChannels
// Four Channels Automatic Bluetooth Control System -Dr. Amyr Zam
#include <SoftwareSerial.h>
SoftwareSerial bluetooth(10,11); // RX, TX
int lightONE = 4;
int lightTWO = 5;
int lightTHREE = 6;
int lightFOUR = 7;
int BluetoothData;
void setup()
{
  bluetooth.begin(9600);
  pinMode(lightONE,OUTPUT);
  pinMode(lightTWO,OUTPUT);
  pinMode(lightTHREE,OUTPUT);
  pinMode(lightFOUR,OUTPUT);
}
void loop()
{
  if (bluetooth.available())
  {
    BluetoothData=bluetooth.read();
    if (BluetoothData=="1")
    {
      digitalWrite(lightONE,1);
      bluetooth.println("ONE OFF");
    }
    if (BluetoothData=="2")

```

Figure 5: Programming Arduino language of Sketches software

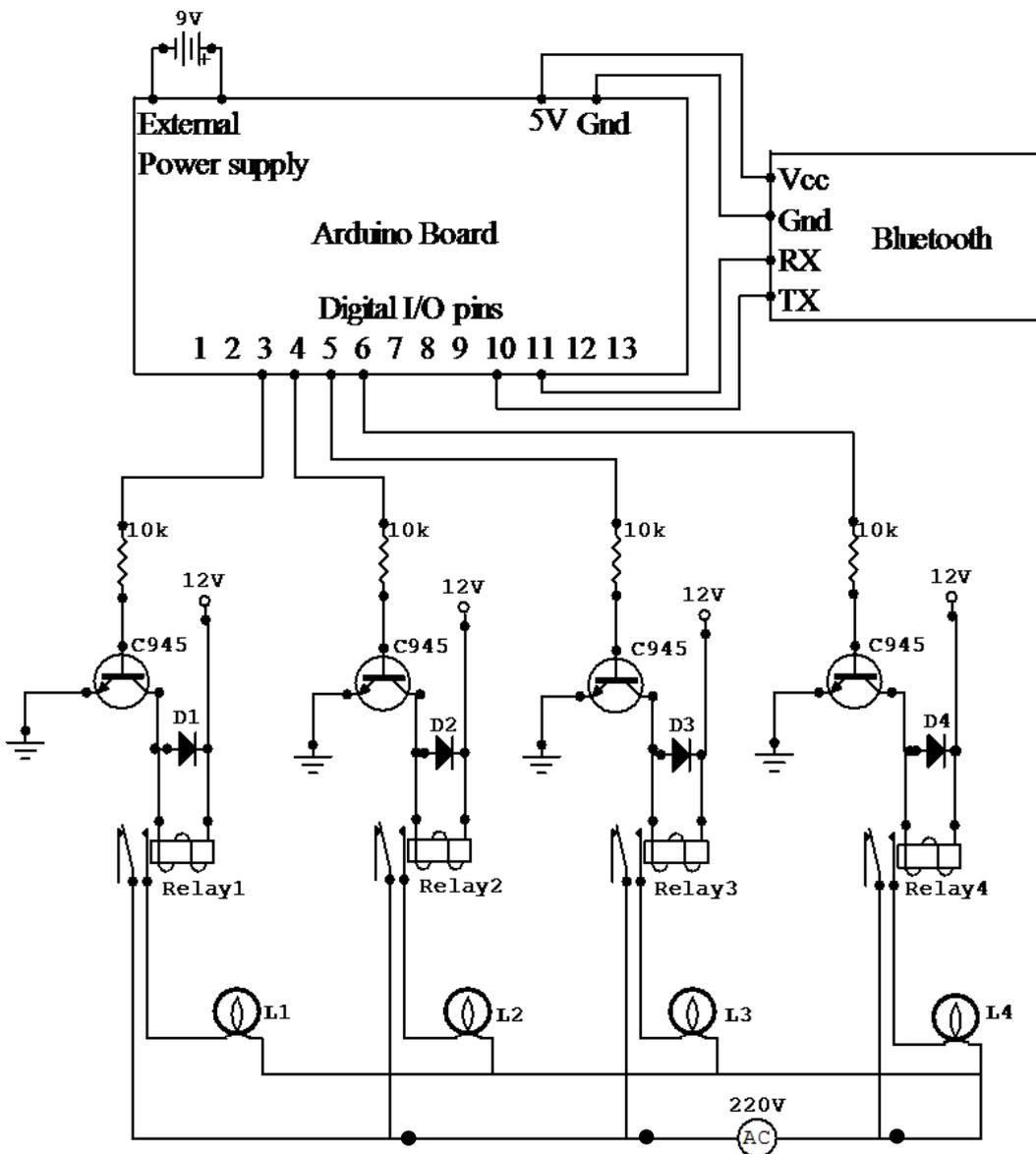


Figure 6: Circuit diagram of four channels Bluetooth control system



Figure 7: The photograph of four channel Bluetooth control system

Results And Discussion

In this paper, four channels automatic Bluetooth control system has been constructed successfully. Circuit diagram of four channels Bluetooth control system is shown in figure 6. The photograph of four channel Bluetooth control system is shown in figure 7.

If typing “1” in the Bluetooth console screen box on Android phone, Arduino output pin 3 is high. The first relay driver circuit is connected to the output pin 3, so the first bulb works in the close condition that turns it on. The Android phone then received the message “ONE ON” on the Bluetooth console screen. If not, typing “a” in the Bluetooth console screen field on the Android phone, the first bulb will turn off and the android phone will receive the message “ONE OFF”. Similarly, if typing “2” in the Bluetooth console screen field on Android phone, the android phone receives the message “TWO ON” and the second bulb is turned on. If typing the letter “b”, the Android phone will receive the message “TWO OFF” and the second light will turn off. If the android phone send message “3”, the third light bulb is turned on. If typing of alphabet “c”, android phone receives the message “THREE OFF” and the third light bulb is turned off. If the android phone send message “4”, the fourth light bulb is turned on. If typing of alphabet “d”, android phone receives the message “FOUR OFF” and the fourth light bulb is turned off. If the android phone sends messages “0”, all light bulbs are turned off and the message “ALL OFF” is received. If the android phone send message “5”, all light bulbs are turned on and the message “ALL ON” is received.

Conclusion

The constructed system can be used to control household electrical appliance remotely by Bluetooth communication technology. Bluetooth technology is a short distance communication technology used by almost all phones including smart phones and all laptops. The relay driver circuit could be directly controlled by Arduino through digital IOs. The all of AC light bulbs can be replaced applicable electrical devices for automation system. The Arduino uno board provides 14 digital I/O pins. Therefore, two pins are used for receiving and transmitting Bluetooth data command. The other 12 pins can be used for output control system. In this paper, 4 pins are used as output control system only for experiment and demonstration of 4 light bulbs ON/OFF conditions. The system can be used for electrical appliances such as TV, air conditioning, pumping water, security and lighting, etc. Four channels automatic Bluetooth control system takes care of a lot of different activities in the house or factory.

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