Smart lighting System by Combination of Arduino and Bluetooth

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*Abstract:-***This paper attempts to achieve smart lighting voice and text control system by using Bluetooth and Arduino UNO as a main processor. In this system used four major components which are Arduino Uno Board, HC-05 Bluetooth Module, Android Smartphone and LEDs. The system is implemented on an embedded platform & is equipped with a bluetooth module (HC-05) which gives the required input for operation. The main objective of this paper is to control the light using bluetooth module via Arduino by voice command or text command from smart phone.**

Keywords: **Aurdino UNO, Android Smartphone, HC-05 Bluetooth Module**

I. INTRODUCTION

The proposed system is Smart Lighting System. LEDs are controlled by voice command or text command through a smart phone. Internet of Things has emerged as one of the most promising technologies for the future [1]. This field is actively researched, and different solutions have been proposed to address the challenges in this area, such as limited amount of energy and cost-efficiency [2]. One of the most discussed topics in IoT is the Home Automation, developing an inexpensive and safe system for indoor use has been a widely researched area which has brought advances in technology and availability of small, flexible, and smart systems. Microcontroller can be regarded as a single-chip special-purpose computer dedicated to execute a specific application. As in general-purpose computer, microcontroller consists of memory (RAM, ROM, and Flash), I/O peripherals, and processor core. However, in a microcontroller, the processor core is not as fast as in general purpose computer, the memory size is also smaller. Microcontroller has been widely used in embedded systems such as, home appliances, vehicles, and toys etc. There are several microcontroller products available in the market, for example, Intel's MCS - 51 (8051 family), Microchip PIC, and Atmel's Advanced RISC Architecture (AVR). Arduino UNO and bluetooth module are discussed in this section.

This system proposed a low-cost system using Bluetooth which help users to voice or text command controls within certain distance from ardroid smatphone[3].

II. BACKGROUND THEORY

An brief introduction about Bluetooth and Arduino is presented. Android technique in smart phone is also presented. These components are the main parts of the proposed system design.

There are three main parts to this project as shown in the following figure. An Android smartphone, a Bluetooth transceiver, and an Arduino.
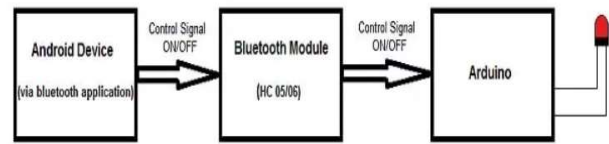
2.1 Bluetooth Module HC-05

HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data.

Bluetooth Module HC-05 is one of the most commonly used piece of hardware which allows you to quickly prototype your ideas which require a wireless control/connective element. This project is a very quick demonstration of how we can interface this module with an arduino board and get going with multiple applications.

The I/O ports of the Bluetooth board and relays are used to connect the devices which be controlled. The Bluetooth simply is password protected. A Bluetooth device has the ability to scan and detect other devices easily. It has the ability of checking whether devices are working properly or not [4].

Figure 1. Bluetooth Module HC-05

2.2 Arduino

Arduino UNO shown in figure (2) is a single board computer. Arduino is an open source physical computing platform based on a simple input/output (I/O) board. The type of the Arduino board used in this paper is ATMega328P Arduino Uno Microcontroller having 2KB static RAM, 32KB flash memory, 8 bit CPU, 6 Analog I/O pins and 14 Digital I/O pins [9]. The language used to program the Arduino microcontroller is C/C++. Programs are created in the Arduino development environment that compiling and linking source code and downloaded to the Arduino board where it start running [6].
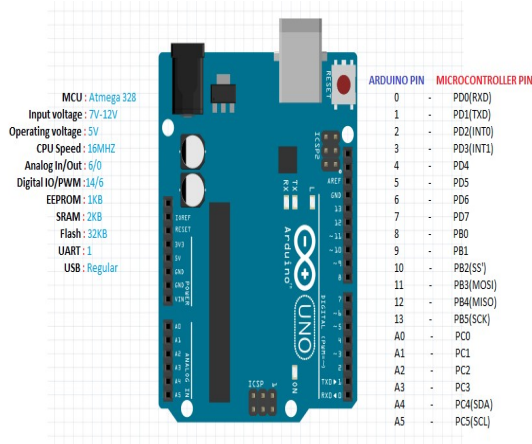

Figure 2. Arduino UNO

2.3 Android

Android operating system is primarily designed for smart phones and tablets. Android applications are written in Java programming language using the Android software development kit (SDK) and run in virtual machines [9]. The ATMega328P Microcontroller is connected by HC-05 Bluetooth Module using wireless technique to the Bluetooth Controller Android application, and the Input/output ports of

the embedded system board are connected to home appliances. Android is the base of the application software, which has the largest base of Smartphone. The Smartphone screen of Android application is shown in figure .

III. PROPOSED SYSTEM

In this paper, smart lighting voice and text control system was designed and implemented using Arduino microcontroller device. The block diagram for the system is as shown in figure (3). This design is in five modules; bluetooth module(HC-05),power supply, android smartphone, leds display and Arduino UNO modules. While the Arduino UNO forms the main control element, the bluetooth module is connected with android smartphone . After connecting successfully, speak or type command the ON to turn the LED on and the OFF to turn the LED off.
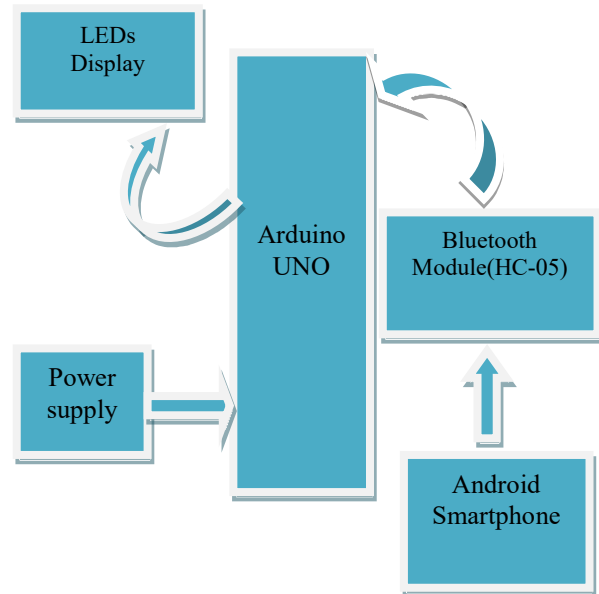

Figure 3. Block Diagram of the smart lighting system

IV. HARDWARE IMPLEMENTATION PROCESS

The microcontroller-based smart lighting system by using bluetooth module and smartphone is designed by both hardware and software controlled.

This system need an Arduino UNO to serially communicate with HC –05 Bluetooth module and a smartphone to send voice command or text command to Bluetooth module HC – 05. After the receiving voice command or text command from smartphone ,display the leds by the various command .The proposed system built the prototype of smart lighting system with arduino UNO android smartphone, leds and Bluetooth module. The overall circuit diagram of the system is described in figure (4).
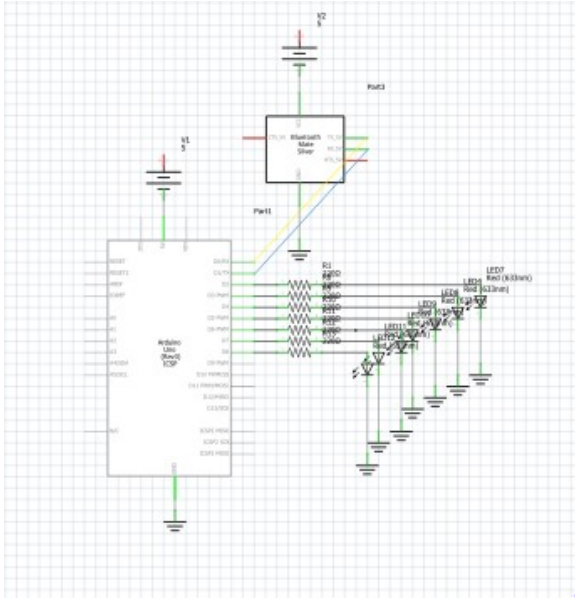
Figure 4. Overall Circuit Diagram

4.1 Pin Connection with Components

Change Pin No. in connection with components and Arduino not to be complex in connecting wires. Pin connections are shown in below table except the Power and GND pins.

The TXD pin of bluetooth module goes to RXD pin of Arduino and the RXD pin of bluetooth module goes to TXD pin of Arduino i.e (digital pin 0 and 1).The Pin no: 2,3,4,5,6 & 7 are configured as digital output to send command to leds for display. LEDs are connected to digital pins. Arduino UNO board is described in figure (2).The following table is described the pin connection with components.

No.	Pin No. of Arduino	Pin of Components	Components
1	2	White led	
2	3	Green led	
3	4	Blue led	LEDs Display
4	5	Pink led	
5	6	Orange led	
6	7	Yellow led	
7	8	Red led	
8	10 (Tx)	Rx	Bluetooth Module
9	11 (Rx)	Tx	

4.2 System Operation

Step 1 : Connect all components as per the circuit diagram; disconnect Rx and Tx pins while uploading the code.

Step 2 : Download the app called "Arduino Bluetooth Voice Controller" which is free on play store.

Step 3 : Open the app and firstly click on "connect to Bluetooth device" and select the bluetooth module and check if it is connected or not. Then click on the microphone icon to speak and send the voice command or to type and send the text command to the HC -05 module.

Note : When the system are connecting the bluetooth module for the first time with the smartphone, it will ask for the passcode, use 0000 or 1234.

While uploading the code in the Arduino UNO, disconnect the Rx and Tx pins and connect again after the code is uploaded.

Step 4 : After setting up all the things, have to send the voice command or the text command by using the app which is further sent to Bluetooth module HC-05 and the HC-05 serially communicate with the Arduino UNO and then the task is performed as per the command.

After hard working, all the parts are connected as circuit design. Then we upload the programming code as we compiled in the Arduino and we get positive result. At last it works properly according to propose design. The following figures are described the speak command and text command the action to be performed by the various command.

Figure(5) When the speak " on or all on " or type " on or all on ", it will perform the following.
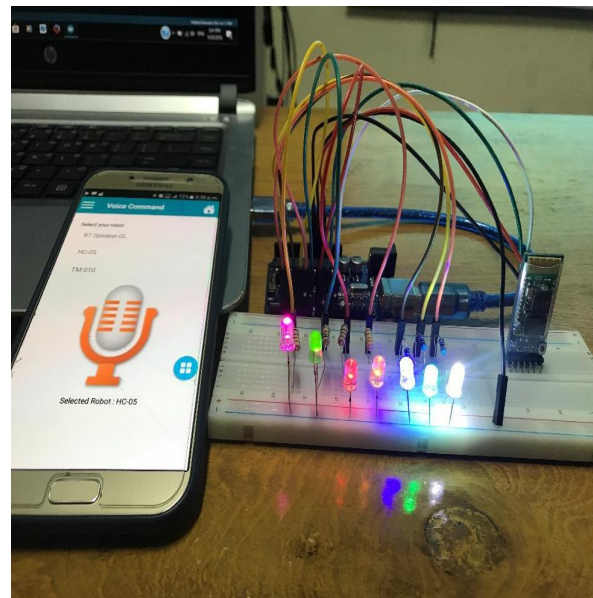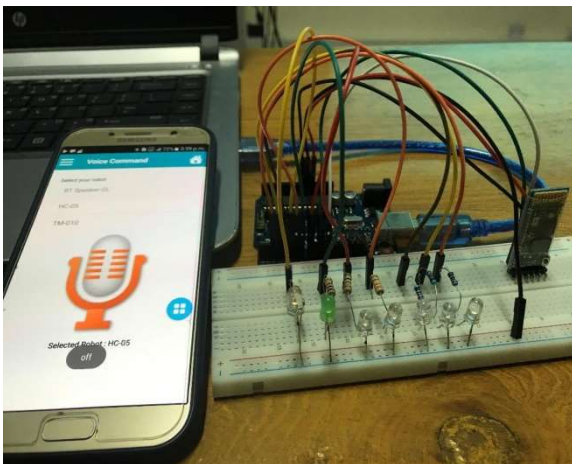
Figure(6) When the speak " off or all off " or type " off or all off ", it will perform the following.
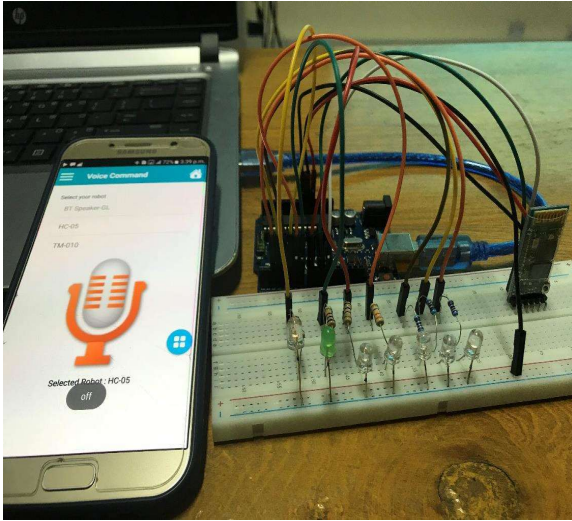
Figure(7) When the speak " pink or pink on " or type "pink or pink on", it will perform the following.

Figure(8) When the speak " off or pink off " or type "off or pink off", it will perform the following.

Figure(9) When the speak "pink on" , "red on" and "orange on" etc: one by one or type the same commands, it will perform the following
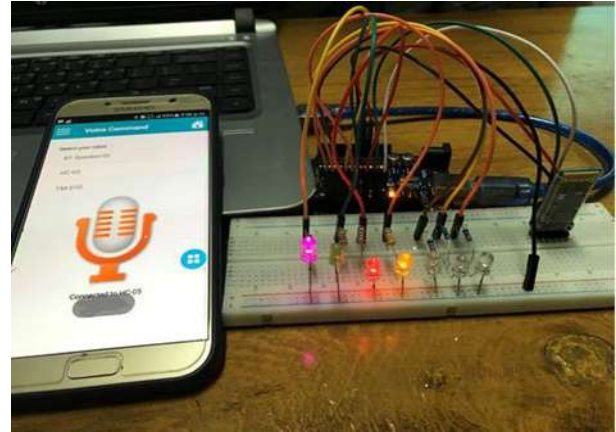
V. CONCLUSION AND FUTURE SCOPE

It can be concluded that the smart lighting system allows people to control light appliances by using a smart phone application. It is necessary to look on hardware and user's smart phone software for developing a smart lighting system. The proposed system has been automatically operated using Bluetooth module according to the data sent by the mobile to Arduino through the Bluetooth interface.

In future, it can control many home appliances in addition to the fan and security alarm system. It can increase the distance of the Bluetooth range by using Wi-Fi. It can be modified with other electronic devices more.

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