HACETTEPE UNIVERSITY DEPARTMENT OF

COMPUTER ENGINEERING

BBM 460 SOFTWARE DESIGN DOCUMENT

Arduino & Bluetooth Based Home Automation

Group Name : Make Wifi Great Again

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1) Introduction

Using wireless network technology to facilitate daily life. You will see how to automate various gadgets of your home and room. You will be able to control the lights, fan, air conditioning, curtains, locks and TV.

1.1) Purpose

As technology is advancing so houses are also getting smarter. Modern houses are gradually shifting from conventional switches to the centralized control system, involving remote controlled switches. Presently, conventional wall switches located in different parts of the house make it difficult for the user to go near them to operate. It becomes more difficult for the elderly or physically handicapped people to do so. Remote controlled home automation system provides the most modern solution with smartphones.

1.2) Scope

Arduino 1.8.13 compiler

Android Studio 4.1

Android Application

A bluetooth module is interfaced to the Arduino board at the receiver end while on the transmitter end, a GUI application on the cell phone sends ON/OFF commands to the receiver where loads are connected. By touching the specified location on the GUI, the loads can be turned ON/OFF remotely through this technology.

Compatible cards (Arduino Uno) are programmed using Arduino 1.8.13

Phone application suitable for phones is created using Android Studio 4.1

Communication between the phone and Arduino Uno using the Android App (GUI application).

1.3) Definitions, Acronyms and Abbreviations

GUI : Graphical user interface

App : Application

IR : Infrared receiver

1.4) References

https://www.elprocus.com/wireless-communication-projects-for-engineering-students/

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https://create.arduino.cc/projecthub/Oniichan_is_ded/simple-home-automation-with-bluetooth-and-relay-8428fa

https://create.arduino.cc/projecthub/kamakshi-s-smart-team/smart-home-automation-185167

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https://www.arduino.cc/en/Reference/Libraries

1.5) Overview

Disadvantages of Bluetooth in home automation:

Limited to Short distance

Not suitable as a receiver , on battery based applications.

Data Rate is low

Limited communication possible

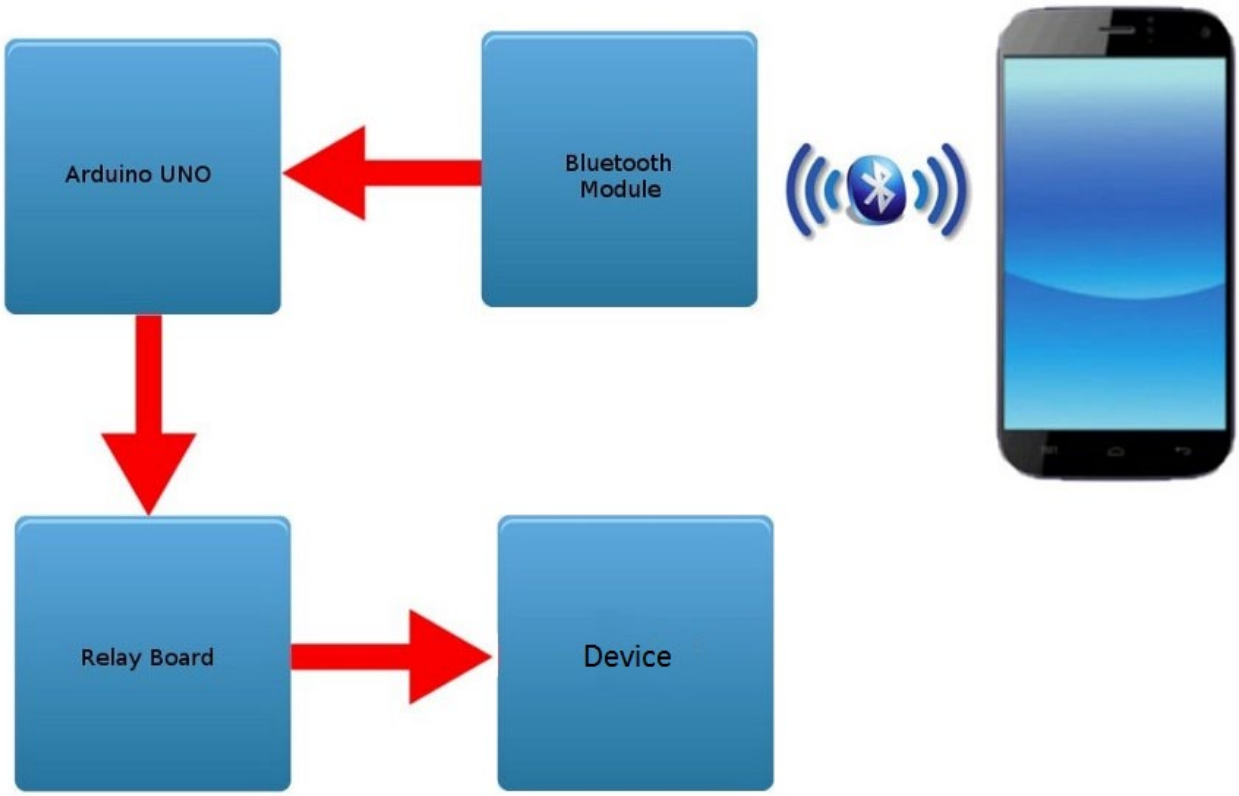
Not a swift way to communicate

Advantages of Bluetooth:

Ideal for first-time configuration/pairing of device

Suitable for short range controls (Instead of IR remote control that requires line of sight, Bluetooth works out better and doesn't need physically projecting sensor as like IR receiver)

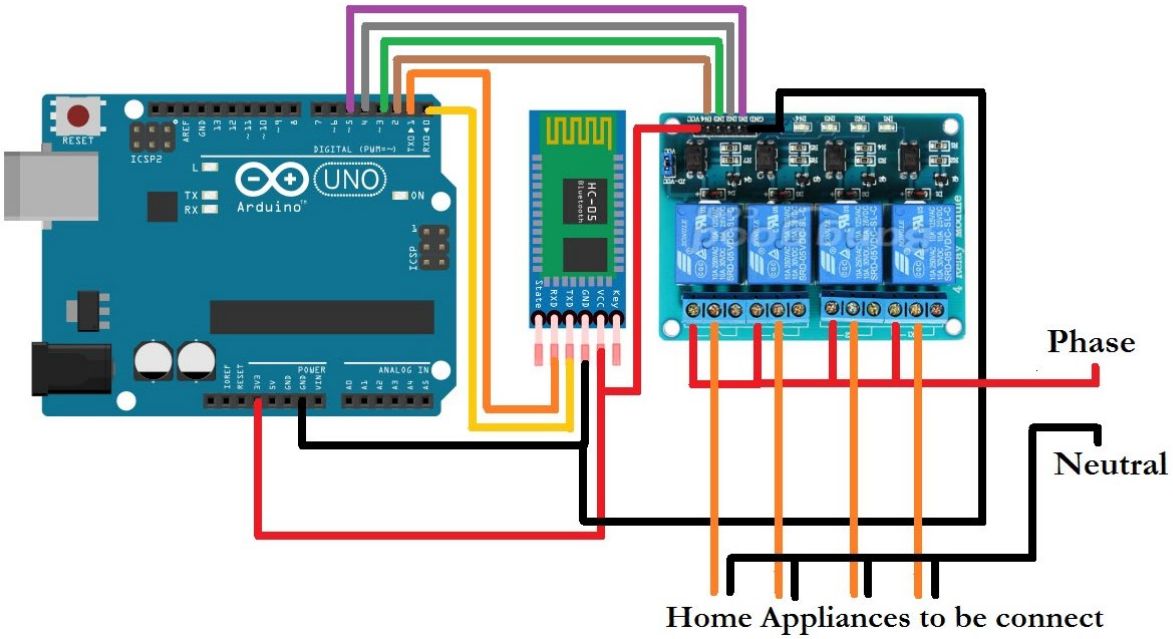
2) System Overview



The android app sends commands to the controller — Arduino, through wireless communication, namely, Bluetooth. The Arduino is connected to the main PCB which has five relays as shown in the block diagram. These relays can be connected to different electronic devices like lights, television, fan, etc.

3) System Design

3.1) Design method



3.2) Decomposition description

Arduino Uno

The Arduino Uno is the most commonly used arduino microcontrollers. An ideal for experiment

Arduino IDE

The Arduino IDE is a free software developed by Arduino LLC based on Processing. It is used to write sketches and bootloaders into the Arduino or ATmega Chip.

HC-05 Bluetooth Module

HC-05 is a Bluetooth module which is designed for wireless comunication. This module can be used in a master or slave configuration.

Arduino 4 Way 5V Relay Module

The 4-way relay control card is a relay board that can control contacts with 5V and can be used with Arduino or other microcontrollers.

4) Component Description

Arduino UNO
Arduino Bluetooth Modül HC05
Arduino 4 Way 5V Relay Module
Breadboard
Connecting wires
Bluetooth enabled smartphone

4.1) Component identifier

4.1.1) Type

Arduino UNO -> logical
Arduino Bluetooth Modül HC05 -> logical and physical
Arduino 4 Way 5V Relay Module -> physical
Breadboard -> physical
Connecting wires -> physical
Bluetooth enabled smartphone -> logical

4.1.2) Purpose

Arduino UNO is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - Bluetooth

Arduino Bluetooth Modül HC05 -> Communicating with other bluetooth devices

Arduino 4 Way 5V Relay Module -> It is a switch that closes / opens circuits that Arduino boards cannot control in terms of current or voltage, thus providing high voltage / current protection.

Breadboard -> Insert electronic component.(Bluetooth module)

Connecting wires -> Connect bluetooth module to Arduino UNO

Bluetooth enabled smartphone -> Sending bluetooth singal

4.1.3) Function

Arduino UNO -> The 8 – bit ATmega 328P microcontroller based Arduino UNO is used in the project to control different components like Bluetooth module and relay network.

Arduino Bluetooth Modül HC05 -> Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth.

Arduino 4 Way 5V Relay Module -> The 4-way relay control card is a relay board that can control contacts with 5V and can be used with Arduino or other microcontrollers.

Breadboard -> A breadboard is a rectangular plastic board with a bunch of tiny holes in it. These holes let you easily insert electronic components to prototype an electronic circuit.

Connecting wires -> Connecting wires provide a medium to an electrical current so that they can travel from one point on a circuit to another.

Bluetooth enabled smartphone -> simplify data sharing between devices

4.1.4) Subordinates

Arduino UNO used by computer (Arduino IDE)

Arduino Bluetooth Modül HC05 used by Arduino UNO

Arduino 4 Way 5V Relay Module used by Arduino Uno

Breadboard and connecting wires used by Arduino Bluetooth Modül HC05

4.1.5) Dependencies

No operation is observed in the circuit created without sending an Android phone bluetooth signal.

There is no operation in the circuit created without receiving data to the bluetooth module.

Arduino Uno does not affect the Relay Module without receiving a signal

Created circuit without power supply will not work.

4.1.6) Interfaces

Arduino IDE

SoftwareSerial.h Library

Android App.

4.1.7) Data

Arduino UNO -> Flash memory (program space),SRAM (static random access memory) , EEPROM

Arduino Bluetooth Modül HC05 -> Bluetooth signal data