

Smart-Home Automation Using Arduino

Dr.K. S. Jagadeesh Gowda¹, Savita B Patil², Vishal Kumar Singh³, Vivek Kumar⁴

Professor, Department of Computer Engineering, Sri Krishna Institute of Technology, Bangalore, India¹

Assistant Professor, Department of Computer Engineering, Sri Krishna Institute of Technology, Bangalore, India²

U.G. Student, Department of Computer Science & Engineering, Sri Krishna Institute of Technology, Bangalore, India³

ABSTRACT: The idea of conserving electricity means that used whenever necessary and avoid wasting it. This means doing simple things like turning OFF lights when any person left the room, etc. One of the biggest motivation for the people is conserving electricity in their homes which is the accumulated savings in their energy bills at the end of the year. So there is a need to conserve the electricity. The main objective of this paper is to control the fan and light using bluetooth module via Arduino. Now a days most of energies are wasted due to the unplug of fans and lights when it is not in use. This is happened because most of the switches are located far away from the users. In order to avoid this situation, we have proposed a low-cost system using Bluetooth which help users to controls the fans and lights within certain distance from them.

KEYWORDS: Arduino UNO, Bluetooth, Ardudroid Software.

I. INTRODUCTION

In present scenario, electricity scarcity is the one of the major problem which the people are facing in everyday life. Resources should be used economically to conserve them for future use since they are limited and will expire on one day [1]. So we need to conserve energy daily to conserve our energy. To overcome the situation a system is to be proposed such that the electrical appliances should be turned OFF when not in use. It is difficult for the user to switch OFF the electrical appliances when the switches are located far away from them. So a system is needed to operate the electrical appliances from a distance. All of us need to conserve energy but the great deal is finding out the best ways to conserve energy and save power. Many methods were proposed for this conservation strategy. But here a system is proposed at low-cost to unplug the fans and light when it is not in use. A home appliance is a device or instrument designed to perform a specific function, especially an electrical device, such as a refrigerator, for household use. The words appliance and devices are used interchangeably. Automation is today's fact, where things are being controlled automatically, usually the basic tasks of turning ON/OFF certain devices and beyond, either remotely or in close proximity [2]. Automation lowers the human judgment to the lowest degree possible but does not completely eliminate it. The concept of remote management of household devices over the internet from anywhere, any time in the world today can be a reality. Assume a system where from the office desk, the user could view the status of the devices and decides to take control by tuning his TV set to his favourite channel, turns on the cooling system, say the air conditioner, and switches on or off some of the lights. This user could walk back home and only find a very comfortable, pleasant home. The recent developments in technology which permit the use of Bluetooth and Wi-Fi have enabled different devices to have capabilities of connecting with each other [3]. Using a WIFI shield to act as a Micro web server for the Arduino eliminates the need for wired connections between the Arduino board and computer which reduces cost and enables it to work as a standalone device. The Wi-Fi shield needs connection to the internet from a wireless router or wireless hotspot and this would act as the gateway for the Arduino to communicate with the internet. With this in mind, an internet based home automation system for remote control of home appliances is designed.

II. RELATED WORK

Richard Harper, in his book "Inside the Smart Home" (2003) [1], provides a fascinating insight into achieving the dream of living in a Smart Home. It draws attention to the complexity, diversity and conceptual richness of domestic life and critically reflects on the adoption and use of technologies in the home, to date. Inside the Smart Home looks at the designs and technologies behind new innovations that can make Smart Home Automation possible, along with their

time-saving, environmental and security benefits, amongst others. Despite these clear advantages however, Smart Homes have so far failed to reach the levels of success originally anticipated, thereby forcing designers to further examine the roles and practicalities of these new technologies.

Technica Pacifica, in the book "Easy X10 Projects for Creating a Smart Home" (2005) [2], has described about the use of X10 technology in implementing Smart Homes. It was developed in 1975 by Pico Electronics of Glenrothes, Scotland. X10 technology uses electrical wires for powering the devices. It was the first general purpose domestic network technology. Communicating over electrical lines is not always reliable because the lines get "noisy" from powering other devices and an X10 device could interpret electronic interference as a command and react, or it might not receive the command at all.

Paulo Novais, Kasper Hallenbog, Dante I. Tapia and Juan M, in the book "Ambient Intelligence Software and Applications" (2012) [4], have spoken about Z wave technology and how it is used in the implementation of Smart Home Automation. Z-Wave is a wireless communications protocol designed for home automation, specifically to remotely control applications in residential and light commercial environments. The technology uses a low-power RF radio embedded or retrofitted into home electronics devices and systems, such as lighting, home access control, entertainment systems and household appliances. Z wave can transmit only up to 75 feet.

Kenneth J. Ayala, in his book "The 8051 Microcontroller" (2004) [5], gives a training to the programmers on programming the Intel 8051 microcontroller, one of the most common microprocessors used in controls or instrumentation applications that use assembly code. The book teaches current principles of computer architecture including simulation and programming, with new state-of-the-art integrated development software.

Albert S. Huang, in his book "Bluetooth Essentials for Programmers" (2007) [6], provides an introduction to Bluetooth programming, with a specific focus on developing real code. The major concepts and techniques involved in Bluetooth programming are discussed, with special emphasis on how they relate to other networking technologies. They provide descriptions and examples for creating applications in a number of programming languages such as Java.

III. CONCEPTS, PROPOSED APPROACH, SCENARIOS AND CONSTRAINTS

3.1 Components required

1. *Arduino Uno with Atmega 328P microcontroller*
2. *HC – 05 Bluetooth Module*
3. *10 K Ω Resistor*
4. *1 K Ω Resistor X 4*
5. *BC547 NPN Transistor X*
6. *1N4007 Diode X 4*
7. *5 V Relay X 4*
8. *Prototyping board (Bread board)*
9. *Connecting wires*
10. *9 V Power supply*
11. *Smartphone or tablet (Bluetooth enabled)*
12. *Arduino 1.6.9 compiler*
13. *Proteus 7*
14. *Android application*

Outputs: A "Universal Remote Controller" which is capable of turning ON/OFF devices connected to it.

3.2 Working Principle

3.2.1: Interfacing Of Bluetooth Module With Arduino

The JY-MCU module communicates with the Arduino via a serial connection. It has four pins that we will be using:

- The Arduino 5v pin is connected to Vcc, and ground pin is the GND connected to the Arduino ground pin. To send the data from the module to the Arduino TXN pin is used and to receive RX which is pin 1 of Arduino is used[7].

3.2.2: Procedure for Sending Data Through Mobile

- Upload the code to the Arduino UNO where we have attached the Bluetooth HC-05 module.
- After Uploading, the Bluetooth module is checked whether the module is working or not.
- Now, go to the Bluetooth Settings in your phone and pair your phone with the HC-05 Device. The key is 1234.
- After successfully pairing, open the ArduDroid App and connect with the HC-05 module.
- In the next step now we can send instructions to the HC-05 with our app. The figure 2 shows the Bluetooth settings in the phone.

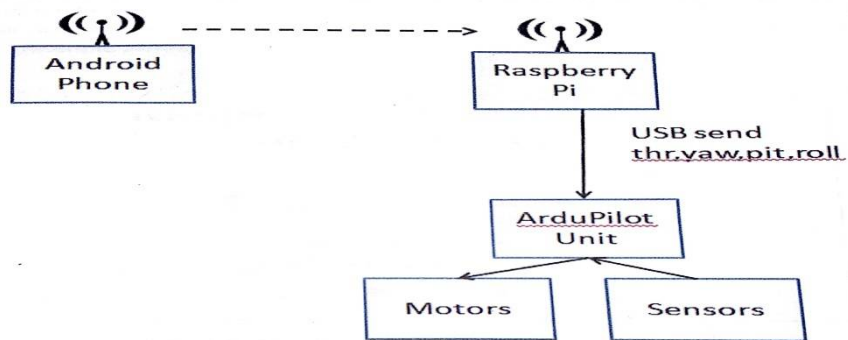


Fig. 1: Functional diagram of the system

3.2.3: Arduroid Software

- It is a simple android application to help us to control pins of the Arduino from our android phone wirelessly. It is both an android app and an Arduino program[8][9]
- This app has been tested and designed for an HC-05 serial bluetooth module. we can use arduroid to send commands to Arduino to control a relay to turn electric gadgets ON or OFF. The figure 3 shows the arduroid software dialog box[10].

3.3 The Proposed Model

3.3.1: Block Diagram:

This paper propose a system in which the electrical appliances like fan and light are operated at a suitable distance with the help of Bluetooth module and Arduino. The block diagram of the proposed system is shown in figure 1. Bluetooth module is connected with the Arduino which interfaces the mobile phone with the Arduino. The Arduino controller is programmed such that the fan and the light are controlled based on the data sent by the mobile phone to the Arduino through the Bluetooth interfacing module.

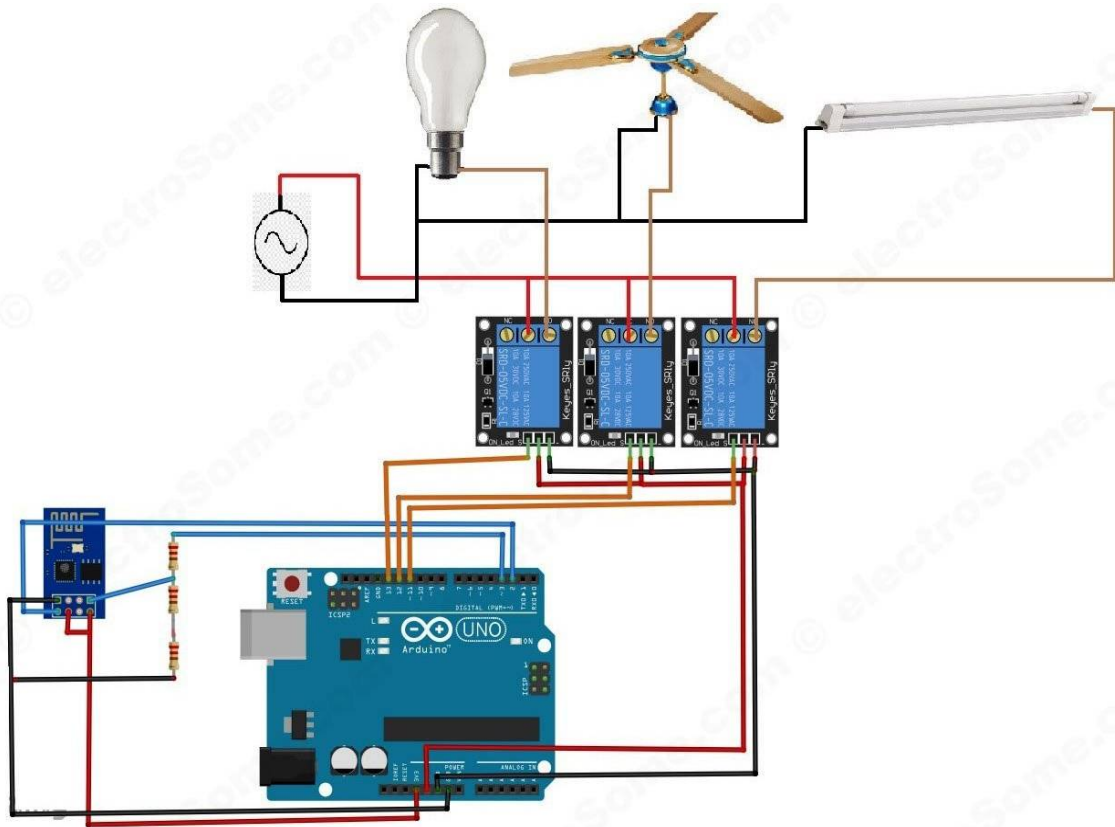


fig.2: Complete proposed model Smart- Home automation system

Bluetooth (CH 05): It is wireless technology standard for exchanging data over short distances (using short wavelength radio waves) from a fixed and mobile devices and building personal area networks ranges approximately 10 meters (30 feet). It is more capable module to use with Arduino [2].

Arduino: Arduino is an open source platform used for building electronic projects. It consists of both the programmable circuit board and a piece of software or IDE that runs on a computer used to write and upload computer code to the physical board.

Fan: In this module we are using a 12 volt cooling fan for which a adapter is used for power supply.

LED: A light emitting diode is a two-lead semiconductor light source. It is PN junction diode which emits light when activated. There are various colors of LED'S available.

IR Sensor: The transistor section includes an IR sensor which transmits continuous IR rays to be received by an IR receiver module and IR output terminal of the receiver varies depending upon its receiving of IR rays [3][4].

3.4 Scenarios

- **Scenario 1: Sequence diagram**

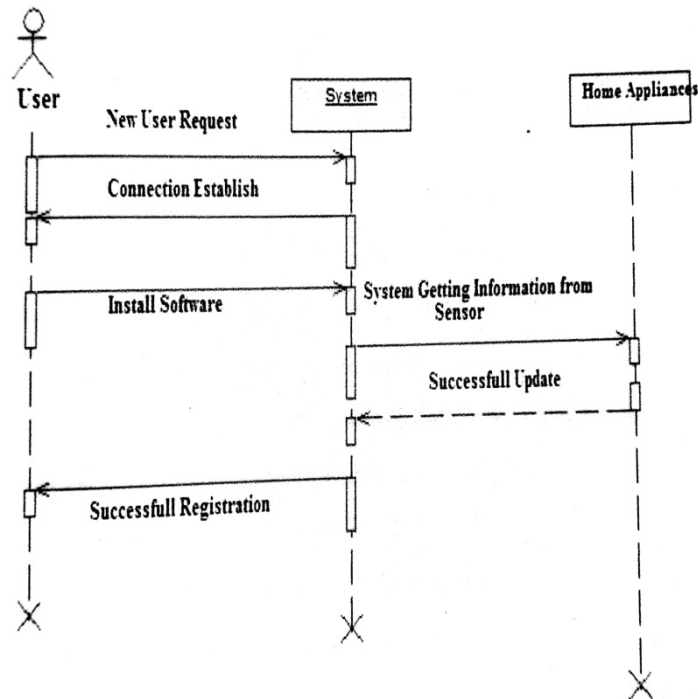


Fig. 3: Sequence diagram – Normal Scenario

A Sequence diagram is an interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. A sequence diagram shows object interactions arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. This project will focus on Smartphones enabled systems for the smart home focus on the Raspberry Pi applications. Although many systems have been researched and proposed, very few if any have been implemented. This project aims to build on the previous research described to implement a wireless sensor network to monitor appliances in the house. These appliances will be controlled via a smartphone running Android OS.

3.4 Constraints

The constraints pertaining to my system are:

- Android Operating System must be installed on the device.
- Bluetooth has a limited range.

IV. EXPERIMENT AND RESULT

6.1 Experimental Results

I illustrated a few experimental results in this section.



Fig. 7: Turning ON Load-1 [Fan]



Fig. 8: Turning OFF Load-1 [Fan]

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