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Home Automation:Wi-Fi Controlled Relay

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ABSTRACT

Today due to technology advancements it is easier to develop automated system for home. Automation of modern appliances alleviates the human standard of living. The main aim of Home automation is to aid differently able and elderly in their everyday life. In this paper, we propose to automate home systems using a wireless link to control light switches and Security systems. The idea is to utilize already existing Wi-Fi signals which are a part of most of the residences. By using Wi-Fi signals, we can eliminate the requirement of employing a separate controlling signal in addition to adding universality and ease of access.

We are essentially constructing a version of a wireless switch to toggle off a light switch or to turn it on when required. The Design will comprise of a Microcontroller board, a wireless break out board or a wireless shield, an electric relay all assembled on a printed circuit board (PCB). It will be interfaced over a PC. The future applicability of the project will not be restricted to the above mentioned uses. It can be exploited on several levels such as, augmenting voice control and gesture control for controlling various domestic appliances or adding a schedule to toggle the appliances.

Keywords-component; Home Automation; Arduino uno; Wi-Fi; CC3000 Breakout Board

I. INTRODUCTION

With advancement in technology we must use this modern expertise and tools to enhance our quality of life. Home automation is one such domain. Home automation means automation of everyday household devices further making easier to do everyday activities. Home automation may consist of centralized control of lightening, Air conditioners, heaters and security systems. Home automation designs provide convenience and improve the quality of life. Home automation systems are also energy efficient. Some Products are available in market which allows automation of appliances with the help of RFID, Bluetooth and ZIGBEE. Here we propose the use of Wi-Fi signals which are now a part of every modern household. With use of these existing signals as method of transmission we will be eliminating the requirement of any separate signal making it more cost effective than other products in market. We will be replacing our regular switch board with a Wi-Fi Breakout Board which will communicate with an Arduino uno controller board. Controlling relay is vital part of any automation systems. With help of relays we can easily toggle off/on any light in our home. In this paper we will demonstrate how to control a relay wirelessly through your computer. To make the design more efficient we will develop a small web server which will run on Arduino controller and will be interfaced over a computer. New appliances can be added anytime in the system making it a flexible and reliable design.

II. SYSTEM OVERVIEW

Figure: 1 elucidates the functional system of the project. The demo system will work by interfacing it over a computer through a web server. The server will comprise of distinct ON/OFF buttons for each switch.

The server will work as central source for providing the instructions to the Wi-Fi module. The Wi-Fi module will then transmit the data given by the user to the controller board using radio waves (2.5 GHz ISM band).The

data to be transmitted is converted into electromagnetic signals and it is decoded at the receiver end and passed on to the controller. The controller will then further operate on the received information and carry out these operations on the appliances. The hardware of design will include:

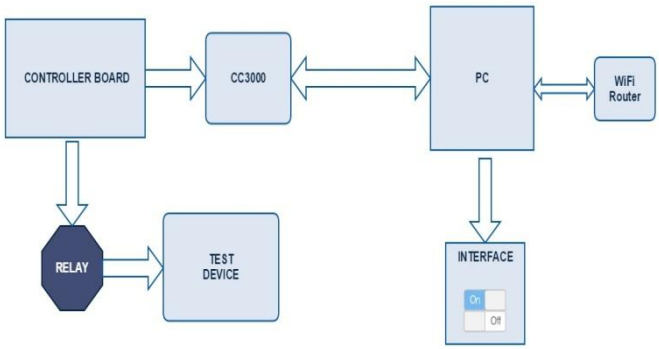

Fig.1: Block Diagram of Home Automation Design

A. **Arduino uno**

We will be using Arduino uno board which is a microcontroller board based on atmega328p. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The board operates on 5v power. The board provides effortless interfacing of I/O pins to a variety of other circuits. Arduino platform provides an integrated development environment (IDE) based on the Processing project, which includes support for C and C++ programming languages.

Fig 2: Arduino Uno Board

B. **Atmel Microcontroller**

We will be using ATmega 328p micro-controller created by atmel. It is a single chip-set microcontroller. It is a High performance low power microcontroller. It combines 32 KB of in system programming (ISP) flash memory with read while write capabilities and 2KB of RAM. Controller has 28 pins out of which 23 works as general I/O lines. It consist of 32 general purpose working registers, three flexible counters, internal and external interrupts, serially programmable USART,SPI serial port, A/D converter and programmable watchdog timer with internal oscillator. The device operates between 1.8 to 5.5 volts.

C. **Wi-Fi Module**

For Wi-Fi module we are using TI designed CC3000. The Texas Instrument module is a self-sustained wireless network processor that simplifies the application of internet connectivity. The key benefit of using this module is it minimizes the software requirement of the host micro-controller. It is a low cost low power solution. It comes integrated with a 802.11b/g radio, modem, MAC supporting WLAN correspondence as a BSS station with CCK and OFDM rates from 1 to 54 Mbps in the 2.4-GHz ISM band. It supports all Wi-Fi security modes for individual systems: WEP, WPA, and WPA2. Smart Config™ WLAN provisioning tools permit clients to connect a headless gadget to a WLAN system utilizing a cell, tablet, or PC. Integrated IPv4 TCP/IP stack with

BSD attachment APIs enables straightforward web integration with any microcontroller, microchip, or ASIC. Simple APIs enable easy integration with any single-threaded or multi-threaded application. It can work on single pre regulated power supply or can be directly connected to a battery.

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Fig 3: Adafruit CC3000 Wi-Fi Board

E. **Relay**

In this project will be using a standard 5v relay. Relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal. The relay will communicate with the controller and perform the action on connected appliance accordingly.

F. **Software: Arduino IDE**

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III. CIRCUIT DIAGRAM

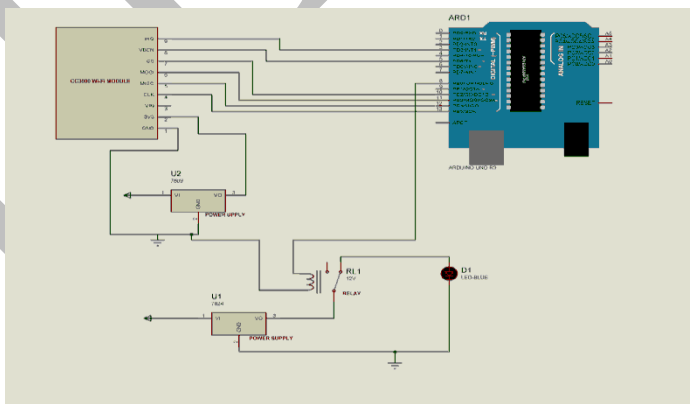

Fig 4: Circuit Diagram

IV. APPLICATION

Following are and could be the future applications of home automation systems:

- Person can universally control all his electronic devices from a single gadget. Use of already existing ISM band eliminates the necessity of employing any other controlling signal.
- Home automation system can provide added security to your house. The user can control security cameras anywhere in home allowing him to monitor the building.
- Integration and control of the security system allowing the user to centrally lock all the doors and windows in perimeter.
- Automation can provide convenience to differently able and older individuals improving their quality of life drastically.
- Automation is also an energy efficient step as it can save hours of energy by schedule toggle of electric devices.
- Further addition of voice and gesture control can improve the home automation systems.

V. FUTURE WORK

At the current stage we were able develop an interface over a PC. This could be further extended by developing applications for android and IOS based devices. The design can be augmented with voice and gesture control.

VI. CONCLUSION

In this paper we presented a demo version of a project which can be further exploited on several levels. Our basic idea was to develop a system which provides universality and is easier to access. This design works on any PC and further can be interfaced over different platforms. The design can be accessed by any of the family members purging the need for someone with technical acquaintance. The system works on Wi-Fi which gives it an added security in terms of protected access (WPA/WPA2).

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