Wireless Home Automation Switch Board Device

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***Abstract*- This project presents a design and prototype implementation of new automation system that uses WiFi technology as a network infrastructure connecting its parts. The proposed system consists of two main components; the first part is the server (web server), which presents system core that manages, controls, and monitors users' home. Users and system administrator can locally (LAN) or remotely (internet) manage and control system code. Second part is hardware interface module, which provides appropriate interface to sensors and actuator of home automation system. Unlike most of available home automation system in the market the proposed system is scalable that one server can manage many hardware interface modules as long as it exists on WiFi network coverage. System supports a wide range of home automation devices like power management components, and security components. The proposed system is better from the scalability and flexibility point of view than the commercially available home automation systems.**

***Index terms*- Home automation, wireless LAN, WiFi.**

1. INTRODUCTION

The project aims at designing an advanced home automation system using normal web server and Wi-Fi technology. The devices can be switched ON/OFF and sensors can be read using a Mobile App through Wi-Fi. Automation is the most frequently spelled term in the field of electronics. The hunger for automation brought many revolutions in the existing technologies. These had greater importance than any other technologies due to its user-friendly nature. Considering the advantages of Wi-Fi an advanced automation system was developed to control the appliances in the house. Wi-Fi (Wireless Fidelity) is a wireless technology that uses radio frequency to transmit data through the air. Wi-Fi has initial speeds of 1mbps to 2mbps. Wi-Fi transmits data in the frequency band of 2.4 GHz. It implements the concept of frequency division multiplexing technology. Range of Wi-Fi technology is 40-300 feet.

The pivotal difference between standard home automation devices and IOT devices is that the IOT devices can transfer and share data over the existing network framework. Also, IOT devices are capable of being controlled remotely over the internet. Present technologies have to rely on different protocols for communication. Also some proprietary and some standards like Wi-MAX, Ethernet, Bluetooth, Z-Wave & Fiber Optics.

The major problem with all these protocols is that they are not suited with each other. Internet of Things is a concept where each device is assign to an IP address and through that IP address anyone makes that device identifiable on internet. Basically it started as the "Internet of Computers". Research studies have forecast an explosive growth in the number of "things" or devices that will be connected to the Internet.

1.1 Literature Review

The paper proposes the development of a firmware for a Smart Switch, which can control the on-off of any electrical device at home by using internet. The Smart Switch is connected to internet via Wi-Fi, through a computer, smart phone, tablet or any device with internet access. In order to perform this connection, it is necessary to write the IP pre-programmed into the Smart Switch in a web browser (Internet Explorer, Chrome, Firefox, etc.) with the purpose to load the Smart Switch server, which will open a configuration page to write the data of the user's network. Then, the user will select in automatic mode the network, the security type, and the user must have written a passphrase. Once these information is uploaded and saved, it is necessary to restart the Smart Switch in order to get access to internet, from which the user can control the Smart Switch simply sending a number one or a number zero to switch the electrical device, this process is

done in principle via the internet, but it can be done without the use of internet, i.e. by using a local network.

2. PROPOSED SYSTEM

In this project, we are going to make a home automation system using ESP8266 WiFi module and Arduino Uno. Using this we will be able to control lights, electric fan and other home appliances through a web browser using your PC or mobile. These AC mains appliances will be connected to relays which are controlled by the Arduino. ESP8266 and Arduino together acts as a Web Server and we will send control commands through a Web Browser like Google Chrome or Mozilla Firefox. ESP8266 is the one of the most popular and low cost wifi module available in the market today. You can ready more about it here, ESP8266 – WiFi SoC.

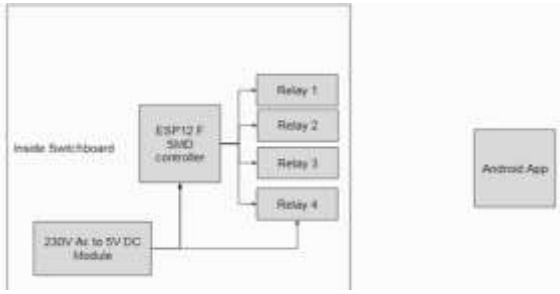

Fig 1: Block Diagram

2.1 Hardware and Software Requirement

1. Hardware:

(a)WEMOS Microcontroller ESP8266:

The board we are using is called "WEMOS d1 Mini" and has an ESP8266 module on it, which we will be programming. It comes with the latest version of Micro Python already setup on it, together with all the drivers we are going to use.

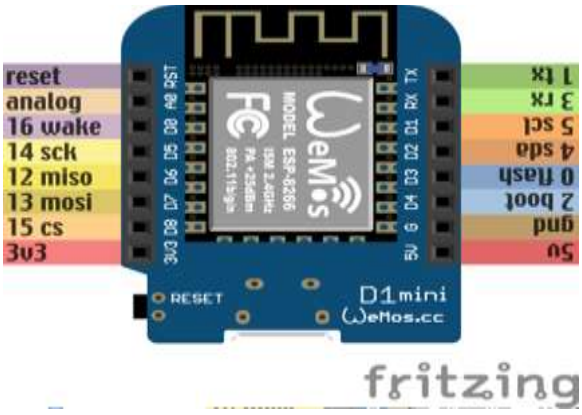

Fig 2: WEMOS Microcontroller ESP8266

(b) Relay:

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, like solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

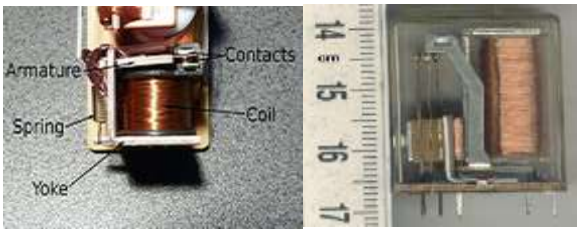

Fig 2.1 : Relay

(c) SMD Transistors:

A three terminal semiconductor electronic device is called transistor. Transistors are widely used in electronic appliances such as computers, radio, audio video equipment, bio medical instrument etc. A transistor is a three layer semiconductor which consists a very thin central layer of one type of semiconductor material sandwiched between two relatively thick layer of second type.

A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit.

Fig 2.2 : SMD Transistor

(d) SMD Resistors:

The resistor is an electrical device. The primary function is to introduce resistance to the flow of electric current. The magnitude of opposition to the

flow of current is called the resistance of the resistor. A larger resistance value indicates a greater opposition to current flow. The resistance is measured in ohms. An ohm is the resistance that arises when a current of one ampere is passed through a resistor subjected to one volt across its terminals. The various uses of resistors are setting biases, controlling gain, fixing time constants, matching and loading circuits, voltage division, and heat generation

Fig 2.3: SMD Resistor

(e) Power Supply 230V to 5V DC:

HLK-PM01 5V/3W Switch Power Supply Module is plastic enclosed PCB mounted isolated switching step-down power supply module. It can supply 5V DC from 120V AC-230V AC and has a power rating of 3 watt. This makes it perfect for small projects that needs a 5 volt supply from mains. There are many advantages for these modules, such as low-temperature rise, low power, high efficiency, high reliability, high-security isolation, etc.

Fig 2.4 : Power Supply

(ii) Programming language:

Arduino IDE :

The arduino code is actually just plain old c without all the header part. When you press the 'compile' button, the IDE saves the current file as arduino.c in the 'lib/build' directory then it calls a makefile contained in the 'lib' directory. This makefile copies arduino.c as prog.c into 'lib/tmp' adding 'wiringlite.inc' as the beginning of it, this operation makes the arduino/wiring code into a proper c file. After this, it copies all the files in the 'core' directory into 'lib/tmp', these files are the implementation of the various arduino/wiring commands adding to these files adds commands to the language. The core files are supported by pascal stang's procyon avr-lib that is contained in the 'lib/avrlib' directory. At this point the code contained in lib/tmp is ready to be compiled with the c compiler contained in 'tools'. If the make operation is successful then you'll have prog.hex ready to be downloaded into the processor.

A program for Arduino hardware may be written in any programming language with compilers that produce binary machine code for the target processor. Atmel provides a development environment for their 8-bit AVR and 32-bit ARM Cortex-M based microcontrollers: AVR Studio (older) and Atmel Studio (newer).

IDE:

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing tex, automatic identing, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2.

2.2 Design and System Architecture

Software of the proposed home automation system is divided to server application software, and Microcontroller (Arduino) firmware.

The server application software package for the proposed home automation system, is a web based application built using asp.net, Microsoft Visual Studio 2010. Server application software runs on windows OS, requires IIS web server, and ".Net" version 4.0 being installed. The server application software can be accessed from internal network or from internet if the server has real IP on the internet using any internet navigator supports asp.net technology. Server application software is responsible of setup, configuration, maintain the whole home automation system. Server use database to keep log of home automation system components, we choose to use XML files to save system log.

The Arduino software, built using C language, using IDE comes with the microcontroller itself. Arduino software is responsible for collecting events from connected sensors, then apply action to actuators and pre-programed in the server. Another job is to report and record the history in the server DB.

The following Fig.3 shows the architecture of the proposed home automation system.

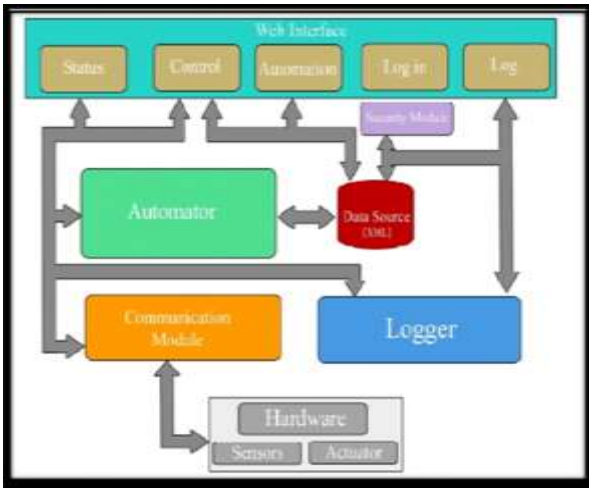

Fig 3: Proposed home automation system architecture

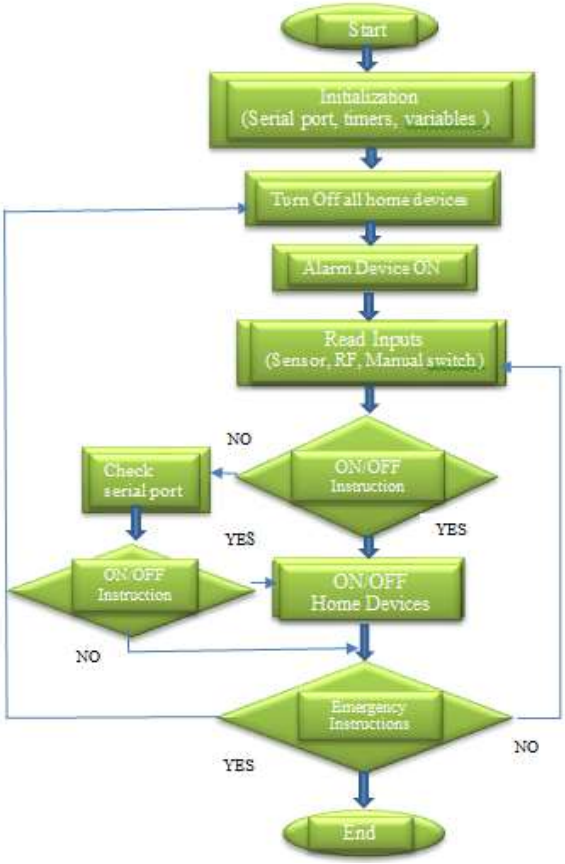

Fig 4 : Flow chart of home automation

3. EXPERIMENTAL RESULTS

Managed to successfully apply the Home Automation System using Arduino and it was user friendly and cost effective. User friendly as in anyone can use just a click of a button on an android screen and everything works. And it is cost effective as in it will cost exactly as the project requires.

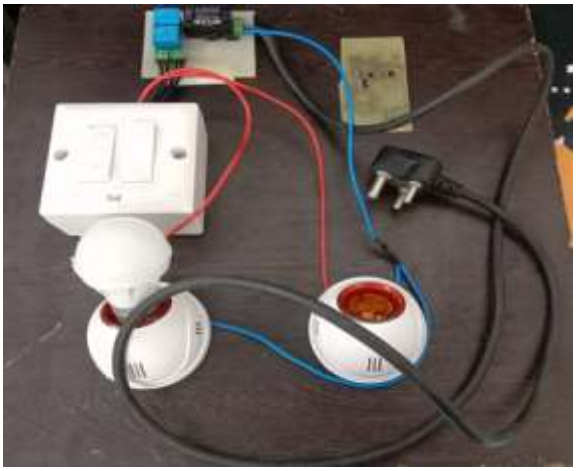

Fig 5 : Hardware setup

4. CONCLUSION

Wi-Fi technology capable solution has proved to be controlled remotely, provide home security and is cost effective as compared to the previously existing systems.

With the help of smart phones or computer the devices can be operated accordingly to the user wish with complete accuracy. In this project we overcome the problem of large data handling by making this smart home technology even more smarter and efficient by enabling smart home appliances by sitting at any corner of the globe with the help of internet.

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