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IOT Based Monitoring and Control System for Home Automation Using Aurdino

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Abstract –
This paper presents an idea or a concept for IOT based home automation using Arduino. Today, home automation industry is growing widely; this is powered by the need to provide systems which provides support for aged and physically handicapped people, especially people who lives alone. This project presents a design and prototype implementation of new home automation system with the help of Arduino that uses IOT Based 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.

Key words**:** *Sensors,, IOT (Internet of Things), Home Automation system, Arduino Uno ,wi-fi technology*

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 Personal Computer (PC) 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. These can be used as a replacement of the existing switches in home which produces sparks and also results in fire accidents in few situations. Considering the advantages of Wi-Fi an advanced automation system was developed to control the appliances in the house. Wi-Fi (Short for 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 controlling device for the automation in the project is a Arduino UNO. The data sent from PC over Wi-Fi will be received by Wi-Fi module connected to Arduino UNO. Arduino UNO reads the data and decides the switching action of electrical devices connected to it through Relays.

2. LITERATURE SURVEY

2.1 Review of Related Literature:

When people think about home automation, most of them may imagine living in a smart home: One remote controller for every household appliance, cooking the rice automatically, starting air conditioner automatically, heating water for bath automatically and shading the window automatically when night coming. To some extent home automation equals to smart home. They both bring out smart living condition and make our life more convenient and fast.

In paper [1], Tan, Lee et.al. proposed the development of an Internet-based system to allow monitoring of important process variables from a distributed control system (DCS). [2] Potamitis, Georgila, Fakotakis, and Kokkinakis, G. (2003) suggested the use of speech to interact remotely with the home appliances to perform a particular action on behalf of the user. [3] In the year 2006 , S. M. Anamul Haque,S. M. Kamruzzaman and Md. Ashraful Islam proposed a system entitled "A

System for Smart-Home Control of Appliances Based on Time and Speech Interaction" that controls the home appliances using the personal computer. [4] Ciubotaru-Petrescu, Chiciudean, Cioarga, and Stanescu (2006) present a design and implementation of SMS based control for monitoring systems. The paper has three modules involving sensing unit for monitoring the complex applications.

[5] Jawarkar, Ahmed, Ladhake, and Thakare (2008) propose remote monitoring through mobile phone involving the use of spoken commands. The spoken commands are generated and sent in the form of text SMS to the control system and then the microcontroller on the basis of SMS takes a decision of a particular task.

[6] This paper presents the design, concept and implementation of IoT (Internet of things) based smart home automation with a low cost and better security. The system is easy and flexible as it uses Arduino board with various sensors to make the system effective.

[7] This paper proposes an efficient implementation for IOT (Internet of Things) used for monitoring and controlling the home appliances via World Wide Web. Home automation system uses the portable devices as a user interface. This project aims at controlling home appliances via Smartphone using Wi-Fi as communication protocol. [8] In this project smart environment condition monitoring by various sensors(Temperature and Light level) for providing necessary data to annually adjust the comfort level in home by optimizing use of energy is developed. In this project Arduino board and Arduino Wi-Fi shield is used. Temperature sensors will also detect the high and low temperatures which will identify the temperature and will notify it on device. [9] This paper focuses on flexible, cost friendly wireless home automation system which would be based on an Android App. The app will be working with the help of Internet of Things.. [10] In this paper authors presented an Home Automation system (HAS) using Arduino Uno with Internet of Things (IoT) which is a concept that imagines all objects around us as part of internet.

2.2 Problem Statement

There is a great energy crisis in current situation of our country. Moreover, people have become negligent in proper utilization of the available energy. People often forget to turn off the light sources and other home appliance while staying out from home. Even in those situations, application of home automation makes it possible to control them from a distant place in easy way with our smart phone. People are constantly running from place to place, working to accomplish everything on our never-ending "to-do" list. Because of the home automation system, we never have to worry about opening the door, switching off the appliances and so on. In short, we can save precious time and experience more daily productivity.

2.3 Proposed Method/System

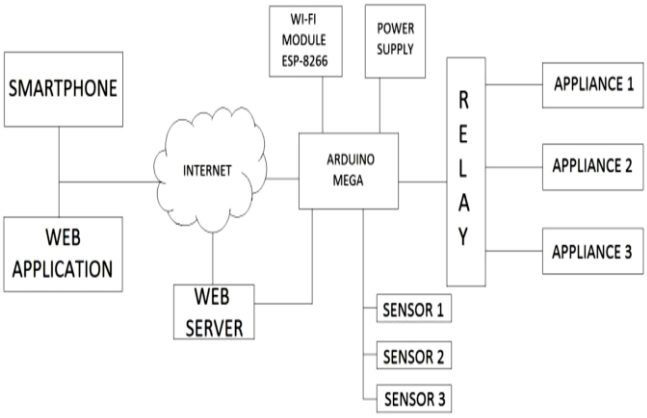

Figure 1. Block diagram of the system

In today's world everyone has shortage of time and in this era of technology there should be a mobile app that could be used to control the home appliances with the help of IOT based Arduino. This project will use the home appliances and will be powered with the Bluetooth and the WiFi making an interconnectivity between the devices and creating an internet of things. In this project the Arduino Mega 2560 and the Arduino Ethernet shield have been used to implement the smart home micro web-server. Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. The Arduino Mega 2560 [10] microcontroller board is based on the ATmega256 having 54 digital input/output pins. The Ethernet is interfaced to the Arduino via the Arduino SPI pins. Low voltage switching relays were used to integrate the devices with the Arduino for demonstrating the switching functionality In this proposed project a mobile app is created and it includes all the features of controlling the home appliances with the help of speech recognition and interconnectivity of devices. The mobile app that is created, contains all the commands

like switching on/off the AC, Fan, Washing machine, etc. Thus this concept basically contains the smart appliances in a home that can be controlled by WiFi and Bluetooth and connected wirelessly with the mobile phones. The mobile app in the mobile phone will be containing the options to give different commands to the appliances and controlling it with our mobile app. The main page of the app will be having the login page that will be used to authenticate the user using the IP Address and the password. After successful login the user will be able to control all the appliances with the mobile app and the voice recognition.There will be switches provided in the app to control the devices and the appliances of the home and these switches can be customized manually or using voice by the user.

3. METHODOLOGY

The proposed system is an IOT Based technology used for operating home appliances using android phone.

- Smart Home -Improves the standard of living at home.
- Control Fan through the mobile application.
- Using vibration sensor and fire sensor.
- Uses GSM and Arduino.

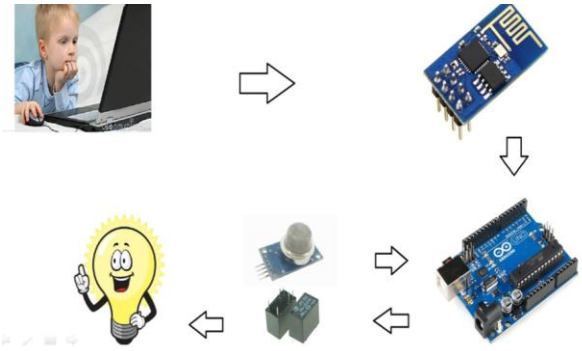

Figure 2. Functional flow

3.1 System Hardware components

3.1.1 The Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6analog inputs, a 16 MHz ceramic resonator, 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 a AC-to-DC adapter or battery to get started.The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, 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 a AC-to-DC adapter or battery to get started..

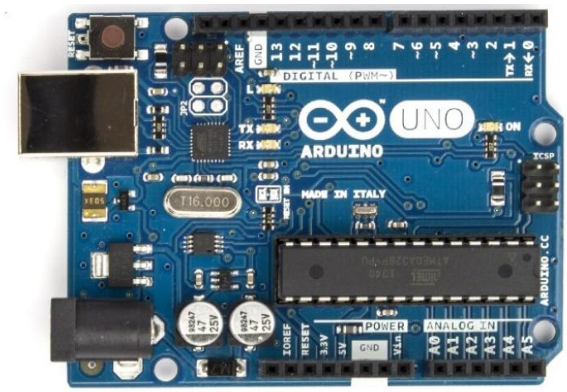

Figure 3. Arduino Uno board

3.1.2 Esp 8266

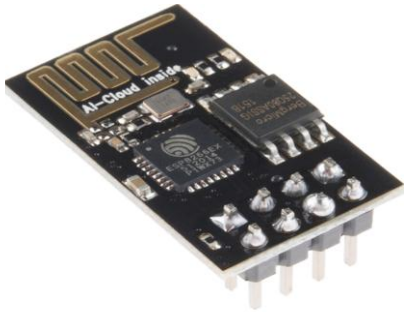

Figure 4. ESP 8266 Wi-Fi module

The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.
This module has a powerful enough on-board processing and storage capability that allows it to be integrated with

the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existance interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

3.1.3 Relay board

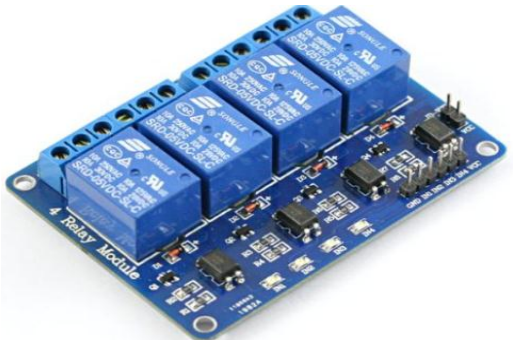

Figure 5. Relay board

A relay is an electrical device which is generally used to control high voltages using very low voltage as an Input. This consists of a coil wrapped around a pole and a two small metal flaps(nodes) that are used to close the circuit. One of the node is fixed and other is movable. Whenever an electricity is passed through the coil, it creates a magnetic field and attracts the moving node towards the static node and the circuit gets completed. So, just by applying small voltage to power up the coil we can actually complete the circuit for the high voltage to travel. Also, as the static node is not physically connected to the coil there is very less chance that the Microcontroller powering the coil gets damaged if something goes wrong. This is Four Channel relay board controlled by computer USB port. The usb relay board is with 4 SPDT relays rated up to 10A each. You may control devices 220V / 120V (up to 4) directly with one such relay unit. It is fully powered by the computer USB port. Suitable for home automation applications, hobby projects, industrial automation. The free software allows to control relays manually, create timers (weekly and calendar) and multivibrators, use date and time for alarms or control from command line. We provide software examples in Labview, .NET, Java, Borland C++, Python.

3.1.4 USB TO TTL CONVERTER

Figure 6. USB to TTL Converter

This USB to TTL converter combine the USB-232-1 (USB to Single RS232 Adapter) and TTL-232-1 (Port-powered RS232/TTL converter) allows you to convert USB to TTL/CMOS compatible levels and vice versa.

3.2 System Software

3.2.1 Webserver

Figure 7. Webpage of system

Required software

i. You will need a Windows PC for this update

ii. You will need some form of USB to Serial converter that allows operation at 3.3V. I used a Focaboard. It allows easy plugging into a breadboard, which then allows me to hookup the pins of the ESP8266 module via jumper wires to the corresponding pins on the USB Serial board.

iii. The firmware updating software only works on COM ports 1-6. If your USB<->Serial device enumerates to a higher port number than that, you will have to change it via Device Manager in Windows

4. CONCLUSION

The home automation using Internet of Things has been experimentally proven to work by connecting simple appliances to it. These appliances were successfully controlled remotely through the internet. The designed system instigates a process according to the user's requirements, for example switching on a fan when it gets hot. Sensors can be implemented to store data which can later be used to analyze the system at hand. By using this application we can control home appliance. This have been implemented using multiple ways such as The Internet, electrical switch, and Graphical User Interface (GUI). By using phones and tablets we can reduce the cost. The system is suitable for remotely controlling the appliances. Here, we have introduced the event of a home management and security system exploitation using Arduino and Internet of Things technology. The system is suitable for real-time home safety monitoring and controlling the home appliances.

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