Design of a Low-Cost Home Automation System using Arduino WIFI Module

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Abstract—**The paper presents the design and technology of a low cost and flexible home control and environmental monitoring system. It employs an embedded micro web server in Arduino Mega 328PU microcontroller, with IP connectivity for accessing and controlling devices and appliances remotely. The devices can be controlled through a web application or via Android based Smart phone app. The proposed system does not require a dedicated server PC with respect to similar systems and offers a novel communication protocol to monitor and control the home environment with more than just the switching functionality. To express the practicability and effectiveness of this system, devices such as light switches, power plug, temperature sensor, gas sensor and motion sensors have been integrated with the proposed home control system.**

Keywords—micro web server; microcontroller; arduino; wi-fi module; relay; home automation;

I. INTRODUCTION

Both our personal and professional life is largely dependent on modern technology developed in recent years. Technology has developed with time and it has transformed the way we purchase products, the today's way of living, the way we communicate, the way we travel, the way we learn and so many other changes have been brought about by the continuous technological advancements. As people's demands and life style are rapidly changing, the demand for advancing the type of technology is obvious [1]. Almost everything we use today has been innovated to better standards so that we can keep up to the ever-progressing times. In the twenty-first century, wireless communication is growing faster than other technological advancements because of its ease of usage and cheaper costs. From WIFI based electronic devices to wireless home automation, people have got advantages in many ways for making their lives easier with lesser stress [2]. This paper proposes a low cost, simple and efficient technology about how to control the home appliances. Based on the Wi-Fi and Arduino the instrument and technique suggested will show how to improve the standard of living with less stress in daily life, particularly efficient for the handicapped persons who have little option to get support from other family members. The security system, in the suggested technology, is also highly effective as well as safer.

II. WIFI BASED HOME AUTOMATION SYSTEM

People who are disabled or handicapped cannot operate the appliances in the home or they cannot reach comfortably close to those things many times. That is why home automation cannot be done in a very efficient way for them. In fact, for most of the time it becomes difficult and not secured for all practical purposes. In order to minimize these problems, a simple home automation system we have designed with the module of Wi-Fi interface. The device will enable its users to operate the electrical systems of their homes from anywhere in the world with the help of wireless communication or specifically by taking support of WIFI [3]. The block diagram of the proposed Wi-Fi based system is shown in Figure 1.
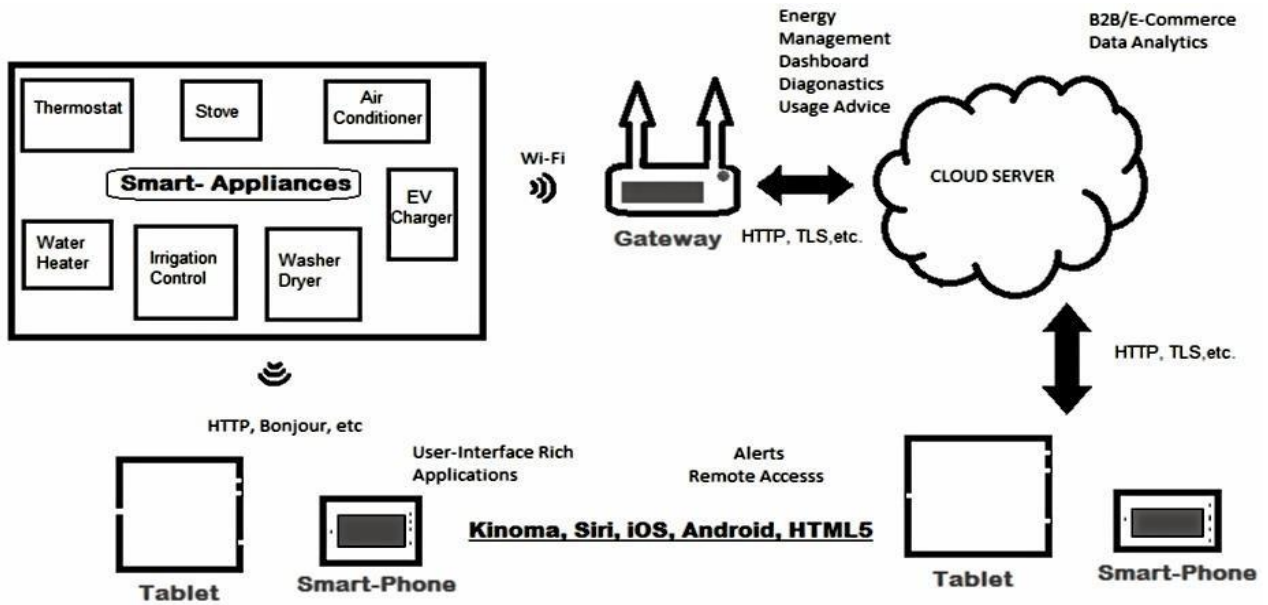
Fig. 1 Block diagram of Wi-Fi based system

III. METHODOLOGY

Figure 2 shows the module of Wi-Fi based system diagram. It is important to note that the Arduino is the main control unit in the system. All the home applications will be suitably controlled by the Arduino link to different available facilities.

In practice, various sensors like temperature, IR sensors and others are to be controlled by Arduino while in the system LCD will be used to display the entered password [4].
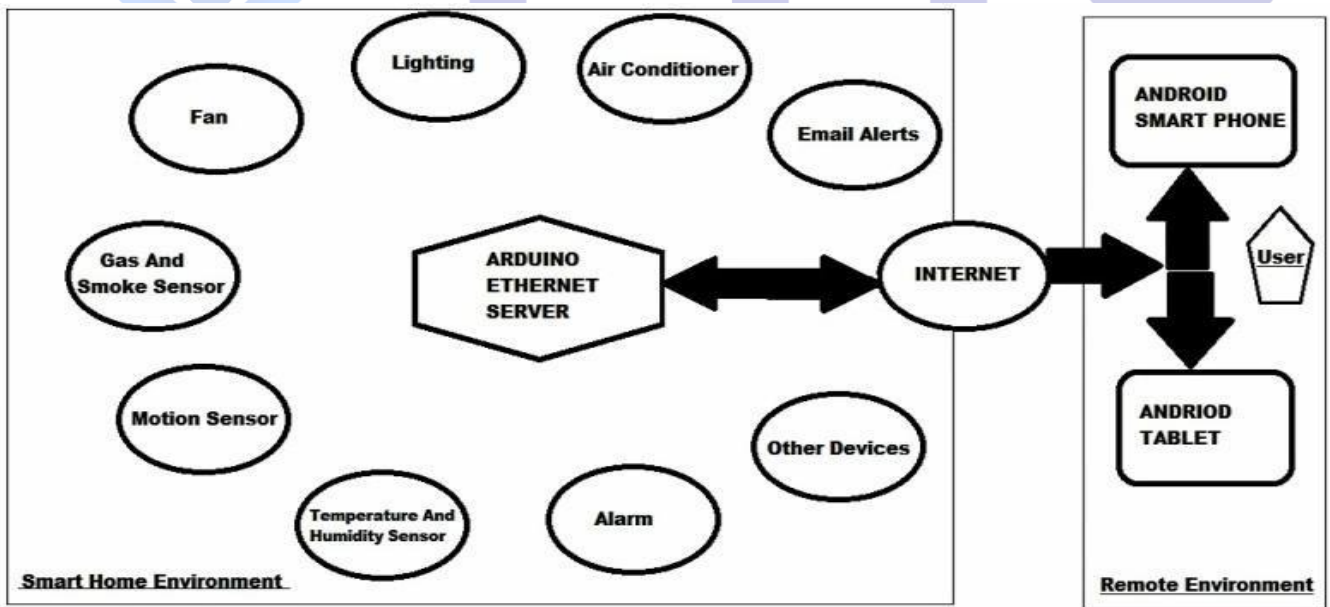

Fig. 2 Module of Wi-Fi based system

IV. DESIGN AND IMPLEMENTATION

A low cost and efficient smart home system that we have designed is shown in Figure 3. A circuit diagram of the system is shown in Figure 4. It has two main modules: (i) the hardware interface module and (ii) the software communication module. At the heart of the whole system, there is the Arduino Mega 328 PU which is capable of functioning as a micro web server and the interface for all the hardware modules. But in the present system we can conveniently use ESP 8266 Module AI- Thinker instead of ESP 8266 normal. The AI used in this system is generic. The module is itself a microcontroller which control all the tubes and fans using relay in home-automation system [5]. The modified program is burned into the AI- Thinker module by the use of Arduino IDE software.
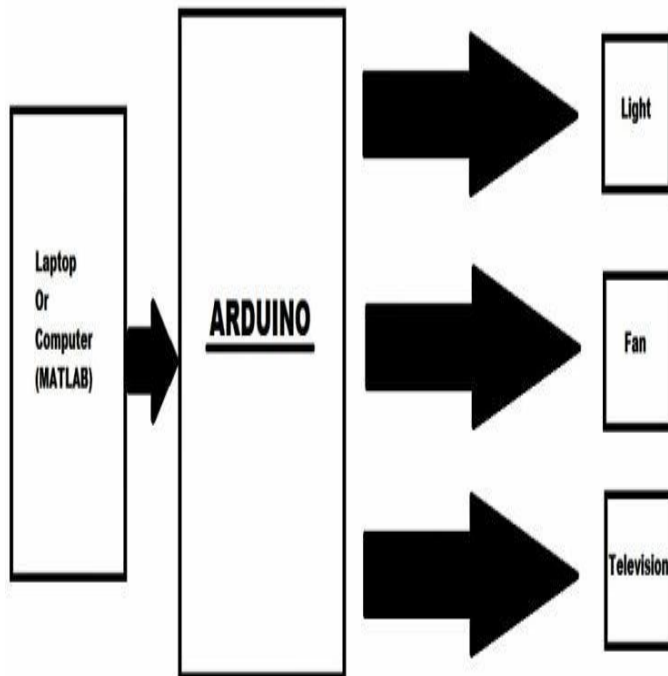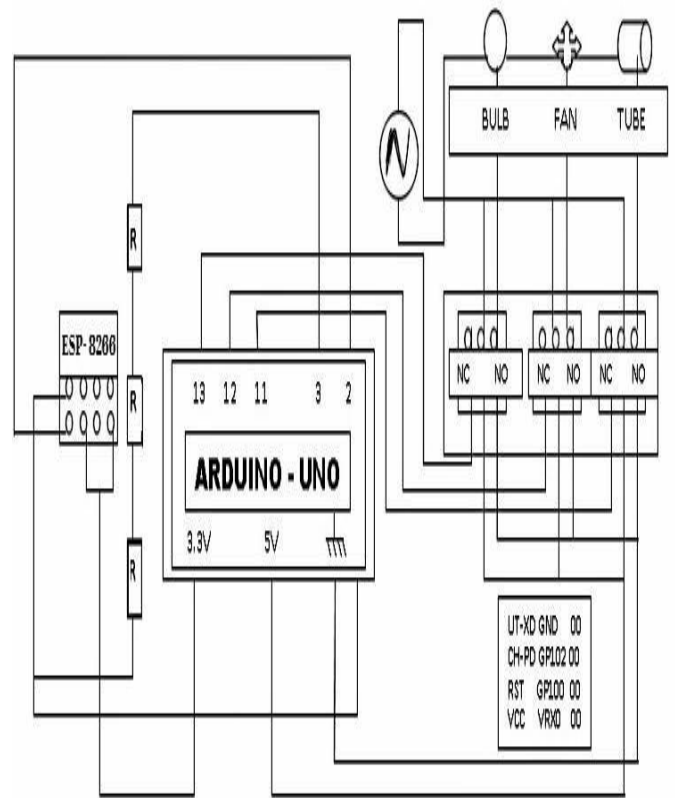

Fig. 4 Circuit diagram of Arduino based system

The main advantage of this system is that it is a low cost but very efficient device for the purpose. If we use Arduino UNO and ESP 8266, then the cost of the system becomes very high in comparison to the proposed model. In this system the use of the AI-Thinker makes the circuit easier to handle with much reduction of the cost.

Fig. 3 Procedural Diagram of Wi-Fi based system

The associated Algorithm showing the different steps to be followed for operation is given below:

Step-1: START

Step-2: Define Arduino and WIFI-module header file

Step-3: Web server client header declaration

Step-4: Define all the integers for different components like fan, tube lights or bulbs

Step-5: Declare output modes for components

Step-6: Setup the WIFI-module router as per the username and password provided

Step-7: Define web link switches as per the fans, tube lights or bulbs will be controlled

Step-8: END

V. WEB APPLICATION AND OTHER ADVANTAGES

Internet Of Things (IOT) is a new revolution of the internet in today's world. A world where the real, digital and the virtual are converging to create smart environments that can cover many areas more intelligently [6, 7]. In recent years, there are many Android and server based applications. In the proposed system, value of the web server through wireless communication and device will be able to show on GUI (Graphical User Interface) or web server through wireless communication and the device will be controlled automatically as well as it will be operated on WIFI. In my system ESP 8266 AI-Thinker should be connected to the WIFI device, like a mobile phone or a home router, through hotspot. When this WIFI system will be connected with a mobile phone or router then by the use of web server, opening a particular website, we can control all the home applications like tube lights or fans, simply by changing the radio buttons already present in the website of the web server.

This is helpful for saving the energy by auto on and off in houses. At night times in major city office buildings as well as in the educational institutes after 6 pm for the door lock password based system it can be used as the key technology of security. Further it can be suitably used to control the speed of the fans. The security system includes a motion sensor which detects the unauthorized movements which will be detected by this system and will alert the user.

VI. CONCLUSIONS

The proposed home automation system using Arduino with WIFI module is versatile, affordable and very convenient. People, particularly adults, face a lot of difficulties to handle home appliances such as switching off lights or fans or turning of air conditioner or even locking car or other electronic devices. The proposed technology will be able to solve those regular problems. It is an energy efficient, labour efficient, cost efficient and time saving smart city project which can definitely improve a person's lifestyle. Moreover, the proposed system will largely assist to handicapped, disabled and aged

people. The simple prototype home automation system in future may expand in many areas.

Acknowledgment

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