Design of Smart Home System Using Arduino

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Abstract

The rapid growth of technology has drastically changed the living standards of modern society. Seeing the increasing number of electronic devices being made in a household, an automated home control system has become an increasing useful feature. Current systems, however, have problems with complexity, high costs, non-open sources and multiple incompatible standards; resulting in the limited venture of the home automation into the homes of the rich or hobbyists. The main objective of this work is to develop a home automation system using an Arduino board with Bluetooth being remotely controlled by any Android OS smart phone. As technology is advancing so houses are also getting smarter. Modern houses are gradually shifting from conventional switches to centralized control system, involving remote controlled switches. Presently, conventional wall switches located in different parts of the house makes it difficult for the user to go near them to operate. Even more it becomes more difficult for the elderly or physically handicapped people to do so. Remote controlled home automation system provides a most modern solution with smart phones. HC-06 Arduino Bluetooth Module and Arduino Uno, LDR and DHT11 temperature and humidity sensors, which are used as light sensors, are integrated to provide reactions according to light, temperature and humidity conditions in the environment.

I.   INTRODUCTION

Nowadays, we have remote controls for our television sets and other electronic systems, which have made our lives real easy. Have you ever wondered about home automation which would give the facility of controlling tube lights, fans and other electrical appliances at home using a remote control? Off-course, Yes! But, are the available options cost-effective? If the answer is No, we have found a solution to it. We have come up with a new system called Arduino based home automation using Bluetooth. This system is super-cost effective and can give the user, the ability to control any electronic device without even spending for a remote control. This project helps the user to control all the electronic devices using his/her smart phone. Time is a very valuable thing. Everybody wants to save time as much as they can. New technologies are being introduced to save our time. To save people's time we are introducing Home Automation system using Bluetooth . With the help of this system you can control your home appliances from your mobile phone. You can turn on/off your home appliances within the range of Bluetooth.

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY) kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler tool chains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

Features of the Arduino UNO:

Microcontroller: ATmega328

Operating Voltage: 5V

Input Voltage (recommended): 7-12V

Input Voltage (limits): 6-20V

Digital I/O Pins: 14 (of which 6 provide PWM output)

Analog Input Pins: 6

DC Current per I/O Pin: 40 mA

DC Current for 3.3V Pin: 50 mA

Flash Memory: 32 KB of which 0.5 KB used by bootloader

SRAM: 2 KB (ATmega328)

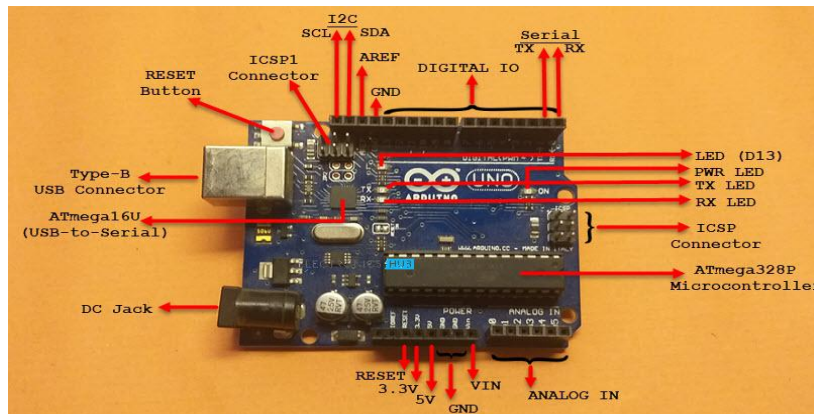EEPROM: 1 KB (ATmega328)

Clock Speed: 16 MHz

Figure 1 : Pins of Arduino R3

II.   LITERATURE SURVEY

Different types of approaches have been made towards home automation. An SMS based method uses GSM technology available in phones to communicate with a microcontroller which acts as the main control for access to home appliances. A GSM module is also required to be attached to the microcontroller through a port to enable SMS capability [1]. The disadvantage of such a system is that it is not user friendly, as there is no graphical user interface, and access codes and command codes must be remembered to operate the system [2]. Another approach focuses on voice recognition to send commands through a wireless RF network. The voice command is captured using a microphone, digitalized, and sent to a computer to be processed by a program based on Visual Basic which employs Microsoft speech API. Upon recognition of the voice command, control signals are sent to the specified appliance addresses for action. The tested system however was not always accurate in recognizing voice commands [3]. Hand gestures were also proposed as control for home automation systems by [4]. A small camera is worn as a necklace to observe the various gestures made by a user's hand in order to interpret and send command signals. The use of such technology, however, requires the use of a high end PC for data processing, resulting in a higher setup cost.
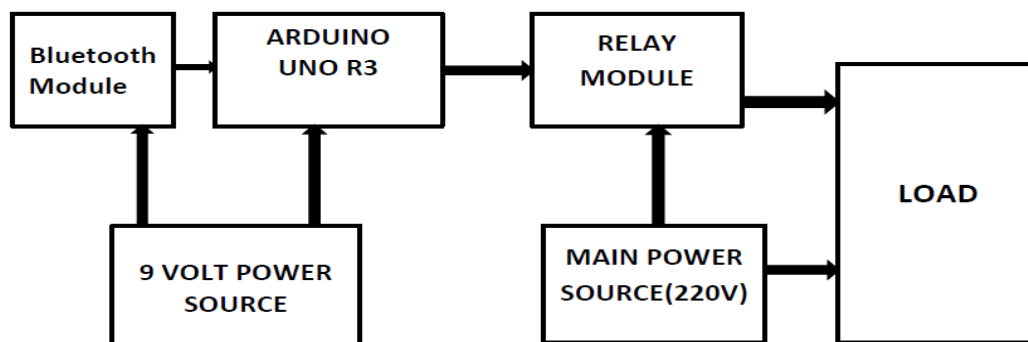
III.   IMPLEMENENATION
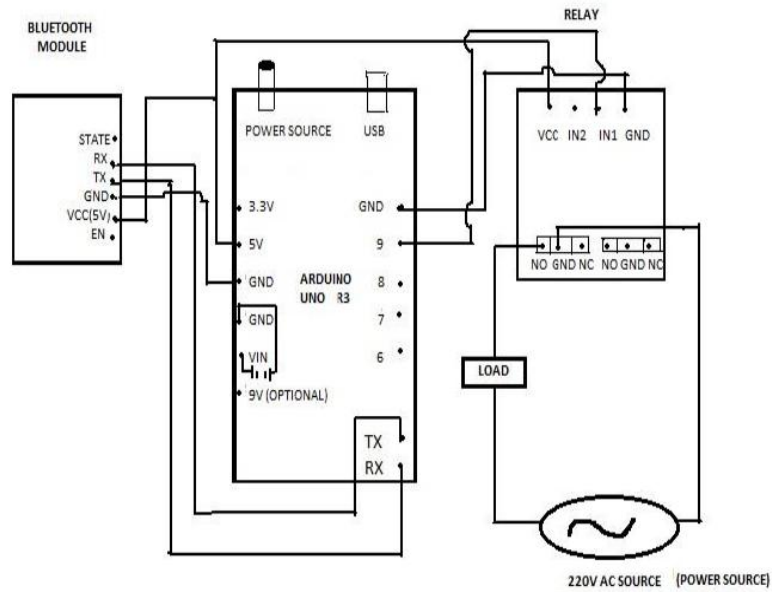

Figure 2: Block diagram of home automation.

Figure 3: Circuit diagram of Implementation

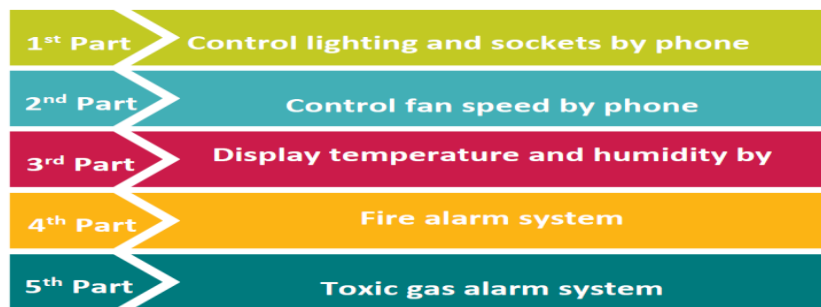| 1st Part	Control lighting and sockets by phone
2nd Part	Control fan speed by phone
3rd Part	Display temperature and humidity by
4th Part	Fire alarm system
5th Part	Toxic gas alarm system

Figure 4: Basic Steps of the implementation.

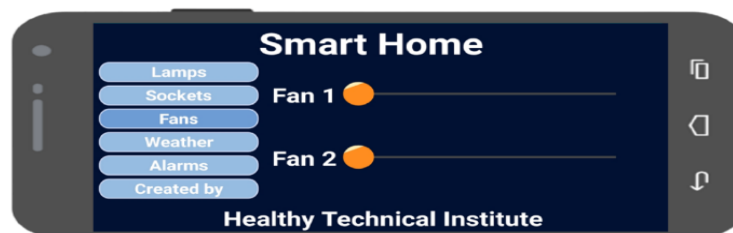Figure 5: GUI-Controls of Lamps on smart phone

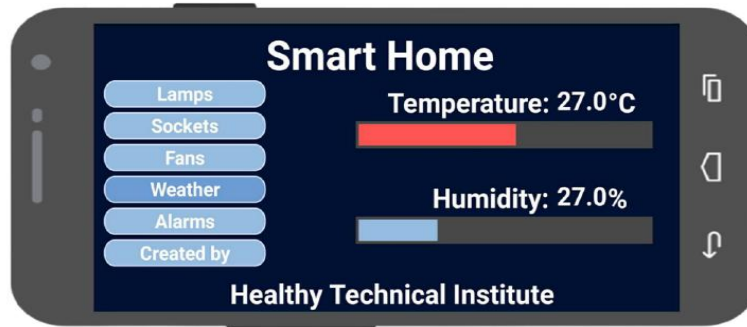Figure 6: GUI-Controls of Fans on smart phone

Figure 7: GUI-Controls to display the temperature and humidity of the smart home on the phone.

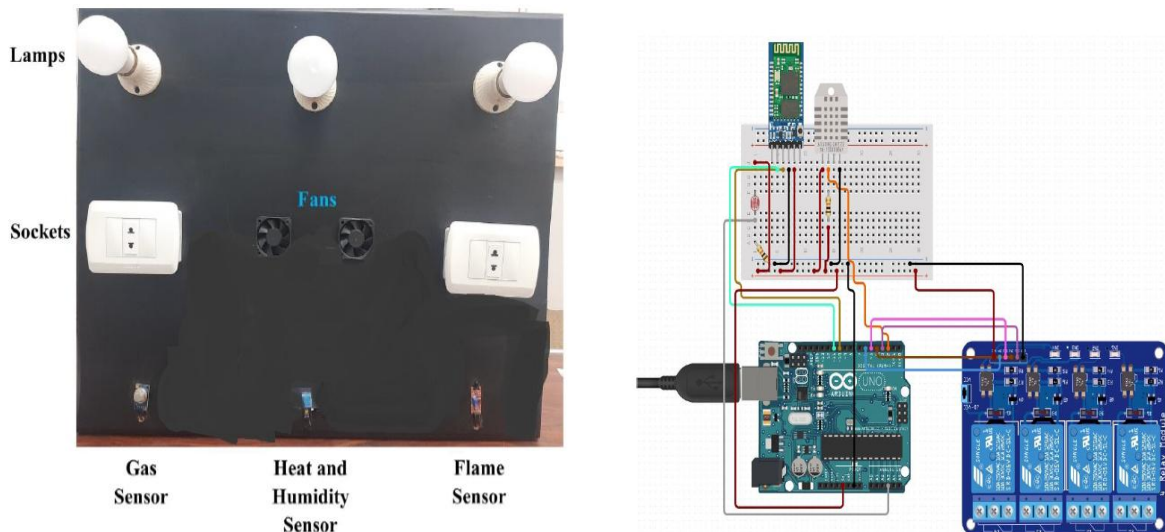Figure 8: GUI-Controls the fire alarm system in the smart home.

Figure 9: Experimental Setup.

IV.   CONCLUSION

The system as the name indicates, 'Home automation' makes the system more flexible and provides attractive user interface compared to other home automation systems. In this system we integrate mobile devices into home automation systems. A novel architecture for a home automation system is proposed using the relatively new communication technologies. The system consists of mainly three components is a BLUETOOTH module, Arduino microcontroller and relay circuits. WIFI is used as the communication channel between android phone and the Arduino microcontroller. We

hide the complexity of the notions involved in the home automation system by including them into a simple, but comprehensive set of related concepts. This simplification is needed to fit as much of the functionality on the limited space offered by a mobile device's display. This paper proposes a low cost, secure, ubiquitously accessible, auto-configurable, remotely controlled solution. The approach discussed in the paper is novel and has achieved the target to control home appliances remotely using the WiFi technology to connects system parts, satisfying user needs and requirements. WiFi technology capable solution has proved to be controlled remotely, provide home security and is cost-effective as compared to the previously existing systems. Hence we can conclude that the required goals and objectives of home automation system have been achieved. The system design and architecture were discussed, and prototype presents the basic level of home appliance control and remote monitoring has been implemented. Finally, the proposed system is better from the scalability and flexibility point of view than the commercially available home automation systems.

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