

Bluetooth based Home Automation System using Smart Phone

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Abstract— Home automation plays a crucial role in human life. Advancements in embedded systems have made home automation to improve the lifestyle of today's generation. In today's world Android devices are very common. Now days there are various electronic devices in homes each having their own control unit. This paper presents a possible solution whereby the user controls devices from a mobile phone through its Bluetooth interface. This results in a simple, cost effective, and flexible system, making it beneficial for future smart home solutions. A prototype of Bluetooth based home automations system using an android phone has been presented in this paper. It also uses ATmega328 microcontroller which provides an interface between Android device and the home appliances which are to be controlled.

Key words: Home Automation, Microcontroller, Bluetooth

I. INTRODUCTION

The 21st century has seen tremendous growth in automation which is playing an important role in our daily lives. The automation industry is at its crest during last few decades since it will help to improve the lifestyle of today's generation. The automation reduces human efforts, labour cost, human errors and it also save time.

The smart home concept has been very popular now days [1]. Smart homes are those homes which contain multiple devices which are controlled by a single module. These devices contain home entertainment consoles, security systems, lighting, access control systems and surveillance. The smart homes are equipped with home automation provides comfort, convenience, and security to home owners. Home automation involves introducing a degree of computerized or automatic control to certain electrical and electronics system in a building.

In this paper the author proposes a home automation system using microcontroller board (ATmega238) with Bluetooth which is being remotely controlled by any Android phone having app installed on it. The advancement in technology is reducing the human efforts by providing smart homes.

Some of the major communication technologies used by today's home automation system include Bluetooth, WiMAX and Wireless LAN (Wi-Fi), Zigbee, and Global System for Mobile Communication (GSM) [2].

The Bluetooth wireless technology is very popular for short distance point to point or point to multipoint communication. It provides many features such as low cost, low power requirement and very small size [3]. The bluetooth technology set to revolutionize the way people perceive digital devices in our homes and office environment. Now they are no longer just the individual devices; instead, with the embedded Bluetooth technology, they form a network in which appliances can communicate with each other. This wireless technology is especially useful in home environment, where there exists hardly any

infrastructure to interconnect intelligent appliances. It could be suitably used for home automation in a cost-effective manner. This technology is a replacement for cables and wire harness [4]. Operating over unlicensed, universally available frequency of 2.4 GHz, it can link digital devices within a range of 10 m (expandable to 100 m, by increasing the transmitted power) at the speed of 1 Mbps. Building upon this theme; we propose a home automation system based on Bluetooth technology [5].

With the development of modern technology, smart phones have become a necessity for every person on this planet. The smart phone is increasingly becoming an important piece of technology which changed human life as it provides a variety of services. In recent years, an open-source platform Android has been widely used in smart phones [6]. Android phones are the most selling smart phones in market today. Android has an active community of developers and enthusiasts who use the Android Open Source Project (AOSP) source code to develop and distribute their own modified versions of the operating system. Applications are being developed on Android systems that are useful to us in various ways.

Android has a complete software package consisting of an operating system, middleware layer, and core applications. Different from other existing platforms like iOS (iPhone OS), it comes with Software Development Kit (SDK), which provides essential tools and Application Programming Interfaces (APIs) for developers to build new applications for Android platform in Java. And also Android platform has support for Bluetooth network stack, which allows Bluetooth-enabled devices to communicate wirelessly with each other in a short distance [7].

Automation without embedded system is impossible. In this paper author uses Atmega328 microcontroller based system. The Atmel ATmega328 is a 32K 8-bit microcontroller based on the AVR architecture. Many instructions are executed in a single clock cycle providing a throughput of almost 20 MIPS at 20MHz. The ATMEGA328-PU comes in a PDIP 28 pin package and is used on our 28 pin AVR Development Board. The high-performance Atmel AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts [8]. ATmega328 is commonly used in many projects and autonomous systems where a simple, low-powered, low-cost micro-controller is needed.

II. SYSTEM DESIGN

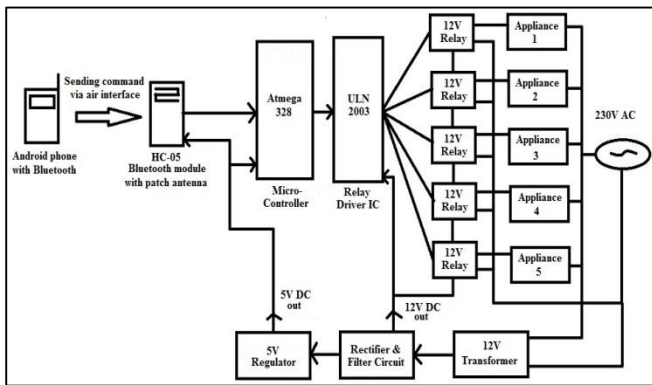


Fig. 1: Block diagram of bluetooth based home automation using smart phone.

The block diagram of the proposed Bluetooth based home automation using smart phone is shown in above figure 1.

As shown in the block diagram it uses an android smart phone, bluetooth module, microcontroller (ATmega328), Relay driver IC and relays.

The heart of this project is an android phone which must have the app installed in it. The installed app will have various control buttons for controlling the states of different appliances. The devices to be controlled can be increased or decreased by selecting particular microcontroller. Here author uses microcontroller ATmega 328. The android phone will send commands using Bluetooth and the installed app. During the first communication a pairing with the desired Bluetooth module is required to which data has to be sent. Once the pairing has been done between the Bluetooth of the android and the Bluetooth module (HC-05) on the microcontroller board MAC ID will be saved in the android mobiles database so for next use no pairing is needed.

On the installed app there are various buttons which are going to turn ON or OFF particular appliances connected to the microcontroller module through relays. When user presses any button on the app it sends a unique ASCII code to the Bluetooth module.

Since the communication medium is Bluetooth the author uses HC-05 a Bluetooth serial interface module which is used at Civil level and not at the industrial level. This level has two types of modules (HC-05, Hc-06) [9]. Generally, these Bluetooth modules have two modes: master and slave device. HC-05 has an advantage where users can set the work mode (master or slave) of the device by AT commands.

The main function of Bluetooth serial module is replacing the serial port line. Once the devices are paired connection can be established between them. This Bluetooth connection is equivalent to a serial port line connection which includes Received, Transmitted signals and they can use the Bluetooth serial module to communicate with each other.

The Bluetooth module will receive the ASCII codes sent by the app. This module has its own on board fabricated patch antenna so no external antenna is required. Generally the market available HC-05 works on 3.3v. But the module used here in proposed circuit will work directly on 5v as in built 3.3v adapter is present.

The microcontroller ATmega308 is connected to the HC-05 using a two wire interface. The communication

between the ATmega308 and the HC-05 uses USART. The bit rate used here is 9600. The ASCII code sent by the app will be received by the HC-05, it will send the code to the ATmega328 using USART protocol on the two wire interface. ATmega 328 reads this ASCII characters as equivalent HEX value which is be ported to its digital pins. Depending on the ASCII code received the microcontroller changes its output.

Suppose button1 in the app has been pressed then the app sends ASCII 'A' via the bluetooth. This ASCII 'A' has been received by HC-05 and forwards the same to microcontroller. Suppose the microcontroller receives 'A' and gives a logic1 (5v) at pin 14(PB0). If the same button1 has been pressed in the app, then the same thing happens but the microcontroller will change its state from the previous one. Now the output at pin14 (PB0) becomes logic0 (0v).

For the purpose of controlling the appliances relays are used. The relay driver (ULN 2003) has been used for driving the relays connected to various appliances. The ATmega 328 output is given to the ULN 2003 which drives the relays and changes its state (ON/OFF). For indicating the ON/OFF condition of the appliances an array of LEDs are used.

The power module is made from 230-12V step down transformer, Rectifier and filter circuit and IC 7805. After that the AC will be converted to DC by rectifier diodes. Smoothing will be done using filter capacitors. Now the output will be fed to 7805 IC. The 7805 will give stable 5v at it's output pin. The ATmega328 and HC-05 will be powered from 5v. The unregulated 12v output is given to the ULN2003 IC & Relays.

III. CONCLUSIONS

The concept of home automation using bluetooth technology is growing very fast. The paper proposes design and implementation of android based home automation system. Bluetooth has been used as the communication medium between android phone and microcontroller (ATmega328) for controlling various electrical appliances. The project has been performing successfully and appliances are controlled according to the commands from android smartphone. Android is widely used among smartphone users; the home automation by using android platform is user friendly as its user interface is based on direct manipulation.

REFERENCES

- [1] B. I. Ahmad, F. Yakubu, M. A. Bagiwa, and U. I. Abdullahi, "Remote Home Management: An alternative for working at home while away," World of Computer Science and Information Technology Journal (WCSIT), Vol. 1(4), pp. 144-147, 2011.
- [2] R. Teymourzadeh, S. A. Ahmed, K. W. Chan and M. V. Hoong, "Smart gsm based home automation system," 2013 IEEE Conference on Systems, Process & Control (ICSPC2013), Kuala Lumpur, Malaysia, 13 - 15 December 2013, pp. 306-309.
- [3] V. Madan and S. R. N. Reddy, "GSM-Bluetooth based Remote Monitoring and Control System with Automatic Light Controller," International Journal of Computer Applications (0975 - 8887), Vol. 46(1), pp. 20-28, May 2012.

- [4] R. Shepherd, "Bluetooth Wireless Technology in the Home," *Electronics & Communication Engineering Journal*, Vol. 13(5), pp. 195-203, 2001.
- [5] N. Sriskanthan, F. Tan and A. Karande, "Bluetooth based home automation system," *Microprocessors and Microsystems*, Vol. 26(6), pp. 281-289, 2002.
- [6] C. C. Chung, S. C. Wang, C. Y. Huang, and C. M. Lin, "Bluetooth-based Android Interactive Applications for Smart Living," 2011 Second International Conference on Innovations in Bio-inspired Computing and Applications (IBICA-2011), Shenzhen, China, 16-18 December 2011, pp.309-312.
- [7] M. Yan and H. Shi, "Smart living using bluetooth based Android smartphone," *International Journal of Wireless & Mobile Networks (IJWMN)*, Vol. 5(1), pp. 65-72, February 2013.
- [8] The ATMEL ATmega32 32KB ISP flash memory
<http://www.atmel.com/devices/atmega328.aspx>
- [9] B. M. Krishna, V. N. Nayak, K. R. K. Reddy, B. Rakesh, P. M. Kumar and N. Sandhya, "Bluetooth based wireless home automation system using fpga," *Journal of Theoretical and Applied Information Technology*, Vol.77(3), pp. 411-420, 31st July 2015.

