

Cell phone-Based Device Control With Voice Acknowledgement

Ujjwal Kumar¹, Deepak Rasaily², Priyanka Rana³

¹ Diploma Student in Dept. of Electronics & Communication Engineering, CCCT Polytechnic

² Sr. Lecturer in Dept. of Electronics & Communication Engineering, CCCT Polytechnic

³ Diploma Student in Dept. of Electronics & Communication Engineering, CCCT Polytechnic
Chisopani, P.O. Nandugaon, South Sikkim, India

Abstract — The use of modern technologies is to achieve the power conservation not only through the proper design of respective devices and other parameters in the power system. A major part of power conservation can be achieved by consumer's proper usage of the power for home appliances, for this purpose "cell phone based device control with voice acknowledgement" is one of the optimal way. Which uses Mobile technology that keeps monitoring of the various appliances, and will control the operation of these appliances with respect to the signal sent by the mobile. For utilization of appliances the new concept has been thought to manage them remotely by using mobile, which enables the user to remotely control switching of domestic appliances. Just by dialling keypad of remote telephone, from where you are calling you can perform ON / OFF operation of the appliances.

Keywords— Dtmf, Microcontroller At8951, Relay Driver, Mobile, Arp9600

I. INTRODUCTION

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4Kbytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer[1]. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89C51 provides the following standard features: 4Kbytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, five vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator and clock circuitry. In addition, the AT89C51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM,

timer/counters, serial port and interrupt system to continue functioning. The Power-down Mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next hardware reset.

II. MY PROJECT

The purpose of this paper is to give a correct Circuit that lets you operate your home appliances like lights and water pump from your office or any other remote place[2]. So if you forgot to switch off the lights or other appliances while going out, it helps you to turn off the appliance with your cell phone. Your cell phone works as the remote control for your home appliances. You can control the desired appliance by pressing the corresponding key. The system also gives you voice acknowledgement of the appliance status.

III. BLOCK DIAGRAM

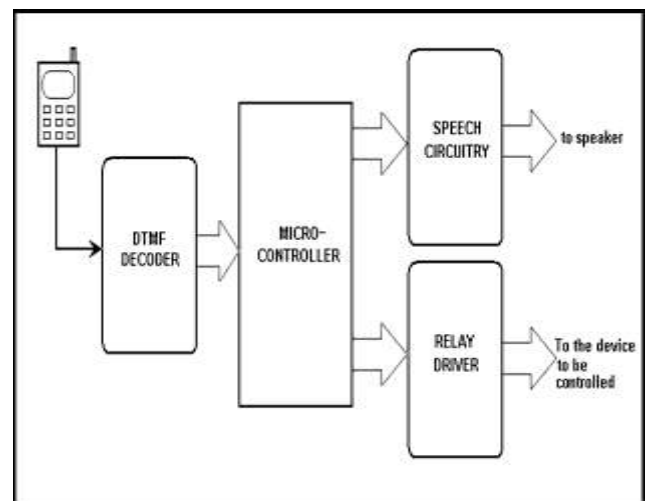


Fig.1 Block Diagram of the Project

DTMF Decoder

This DTMF (Dual Tone Multi Frequency) decoder circuit identifies the dial tone from the telephone line and decodes the key pressed on the remote telephone[3][4]. Here for the detection of DTMF signalling, we are using the IC MT8870DE which is a touch tone decoder IC. It decodes the input DTMF

to 5 digital outputs. The M-8870 DTMF (Dual Tone Multi Frequency) decoder IC uses a digital counting technique to determine the frequencies of the limited tones and to verify that they correspond to standard DTMF frequencies. The DTMF tone is a form of one way communication between the dialer and the telephone exchange[5]. The whole communication consists of the touch tone initiator and the tone decoder or detector. The decoded bits can be interfaced to a computer or microcontroller for further application.

Microcontroller

Microcontroller AT89C51 is at the heart of the circuit. It is a low-power, high-performance, 8-bit microcontroller with 4 kB of flash programmable and erasable read-only memory (PEROM) used as on-chip program memory, 128 bytes of RAM used as internal data memory, 32 individually programmable input/output (I/O) lines divided into four 8-bit ports, two 16-bit programmable timers/counters, a five-vector two-level interrupt architecture, on-chip oscillator and clock circuitry. A 11.0592MHz crystal (XTAL1) is used to provide basic clock frequency for the microcontroller.

Relay Driver IC ULN2003

The relay driver uln2003 ic is a high voltage and current Darlington array ic, it comprises of 7-open collector Darlington pairs with common emitters. A pair of Darlington is an arrangement of two bipolar transistors[6]. This IC belongs to the family of ULN200x ICs and various types of this family interface to various logic families. This ULN2003 IC is for 5V TTL and CMOS logic devices. These ICs are used as relay drivers as well as to drive a wide range of loads, line drivers, display drivers etc. This IC is also normally used while driving Stepper Motors. The pairs of Darlington in ULN2003 are esteemed at 500mA and can withstand peak current of 600mA.

APR9600

The APR9600 provided all the necessary features for recording and playing the audio with very fewer external components at a very low cost. May be many of you are aware that the APR9600 audio recorder and playback IC is no longer manufactured! The chip was manufactured by a Taiwan based company called APLUS Integrated Circuits Inc. I have searched for it in retail shops all across SP road Bangalore but the vendors said that the chip is no longer manufactured.

IV. CIRCUIT AND PCB LAYOUT

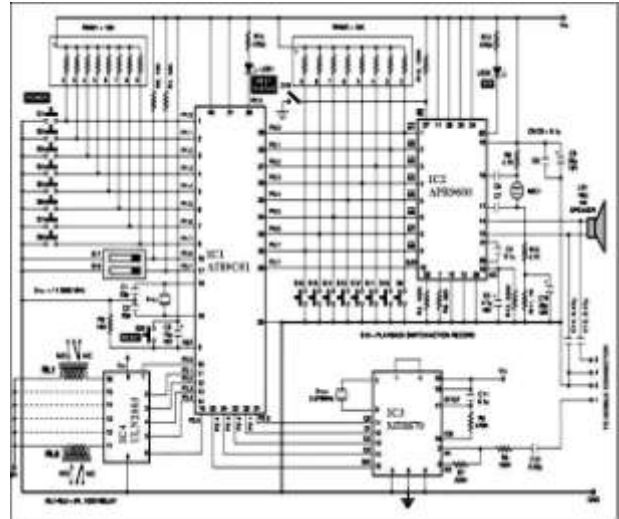


Fig.1 shows the circuit for cell phone based device control with voice acknowledgement. It comprises microcontroller AT89C51, DTMF decoder MT8870, voice recording/playback device APR9600.

Microcontroller AT89C51 is at the heart of the circuit. It is a low-power, high-performance, 8-bit microcontroller with 4 kB of flash programmable and erasable read-only memory (PEROM) used as on-chip program memory, 128 bytes of RAM used as internal data memory, 32 individually programmable input/output (I/O) lines divided into four 8-bit ports, two 16-bit programmable timers/counters, a five-vector two-level interrupt architecture, on-chip oscillator and clock circuitry. A 11.0592MHz crystal (XTAL1) is used to provide basic clock frequency for the microcontroller. Capacitor C3 and resistor R3 form the power-on reset circuit, while push-to-on switch S20 is used for manual reset. Port pins P1.0 through P1.7 of the microcontroller are configured to get the input from push-to-on switches S1 through S8. Pins of Port P1 are pulled high via resistor network RNW1. Port pins P2.0 through P2.4 are configured to receive the decoded DTMF signal from DTMF receiver MT8870[7]. The functions of the corresponding switches (S1 through S8) and cell phone keys are shown in Table I.

**TABLE I
Functions of Switches and Mobile Keys**

Switches	Mobile key	Function
S1	1	Select Device 1; Or/Off
S2	2	Select Device 2; Or/Off
S3	3	Select Device 3; Or/Off
S4	4	Select Device 4; Or/Off
S5	5	Select Device 5; Or/Off
S6	6	Select Device 6; Or/Off
S7	*	Initialise to inform the status of the device
S8	#	Or/off the voice alert

The DTMF decoder is used for decoding the mobile signal. It gets DTMF tone from the mobile headset's speaker pins and decodes it into 4-bit digital signal. The DTMF decoder is operated with a 3.579MHz crystal (XTAL2) In DTMF receiver MT8870 (IC3), capacitor C12 is used to filter the noise and resistors R6 and R7 help to amplify the input signal using the internal amplifier. Pin 16 of IC3 connected to resistor R5 provides the early steering output. It goes high immediately when the digital algorithm detects a valid tone pair (signal condition). Any momentary loss of signal condition causes Est. to return to low state. Pin 17 of IC3 connected to capacitor C11 is bidirectional, acting as steering input/guard time output (St/GT). A steering logic V_{Tst} detected at St Causes the device to register the detected tone pair. The guard time output resets the external steering time constant, and its state is a function of ESt and the voltage at St. Port P3 pins P3.6 and P3.7 of IC1 are configured to select the control source for the devices. These are connected to DIP switches S17 and S18 and pulled high via resistors R2 and R1, respectively. Here, we are using two control sources, switches and mobile's key. DIP switches S17 and S18 select the control sources as shown in Table II.

S17	S18	Control status
0	0	Rest status
0	1	Switches only
1	0	Mobile only
1	1	Switches and mobile

Pin 2.5 of Port P2 is configured to show the rest status. That is, if none of the control sources is selected by DIP switches S17 and S18, LED1 glows. Resistor R14 limits the current through LED1. Voice acknowledgement is provided by the APR9600 (IC2). It is a single-chip voice recording and playback device that can record and play multiple messages at random or in sequential mode for 60 seconds. The user can select sample rates with corresponding quality recording lengths. Microphone amplifier, automatic gain control (AGC) circuits, internal anti-aliasing filter, internal output amplifier and message management are some of the features of the APR9600. Here the APR9600 is configured in random-access mode, which supports two, four and eight messages of fixed durations. The length of each message is the total recording length available divided by the total number of memory segments/tracks enabled[10]. Audio processor APR9600 can store up to eight voice messages. Port P0 pins and P2.7 are configured to communicate with IC2. Port P0 pins trigger selection of the message. Port pin P2.7 is the input signal to identify whether the voice message is

playing or not. Pins P3.0 through P3.5 of Port P3 control the devices with the help of relays RL1 through RL6 via relay driver IC4. A speaker is connected to IC2 for audio output. The speaker output drives the mic input of the mobile for audio acknowledgement. An electret microphone MIC1 is connected to IC2 to record the voice in IC2. LED2 flashes to show the busy status of IC2 during recording and playback. The audio messages to be recorded in APR9600, by using trigger switches S9 through S16, are shown in Table III.

Switch	Trigger of IC	Voice
S9	1	Name of Device 1
S10	2	Name of Device 2
S11	3	Name of Device 3
S12	4	Name of Device 4
S13	5	Name of Device 5
S14	6	Name of Device 6
S15	7	"Status On"
S16	8	"Status Off"

SPST switch S19 is closed for recording and switch S19 is opened for playback.

Recording and playback

To record the voice in IC2, follow Table III. Close SPST switch S19 to make pin 27 of IC2 low. Thereafter, press and hold switches S9 through S16 to record corresponding voice messages. LED2 flashes to indicate audio recording[8][9]. For playback of any device status, open SPST switch S19 and press the corresponding switch (S9 through S16). The recorded audio can be heard from the speaker connected to pins 14 and 15 of IC2. Fig.2 shows the pin configuration of mobile headset.

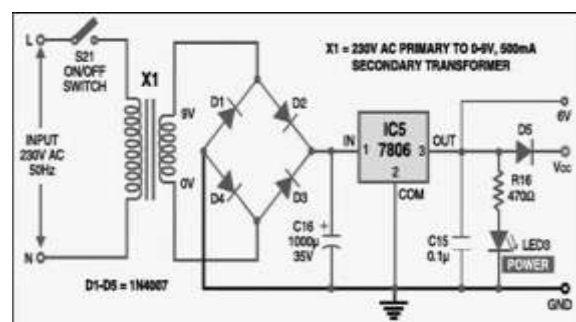


Fig.3 shows the power supply circuit. The 230V AC mains is stepped down by transformer X1 to deliver the secondary output of 9V, 500 mA. The transformer output is rectified by a full-wave bridge rectifier comprising diodes D1 through D4, filtered by capacitor C16 and then regulated by IC 7806 (IC5). Capacitor C15 bypasses the ripples present in the regulated 6V power supply. LED3 acts as a power-on indicator and resistor R16 limits the current through LED3.

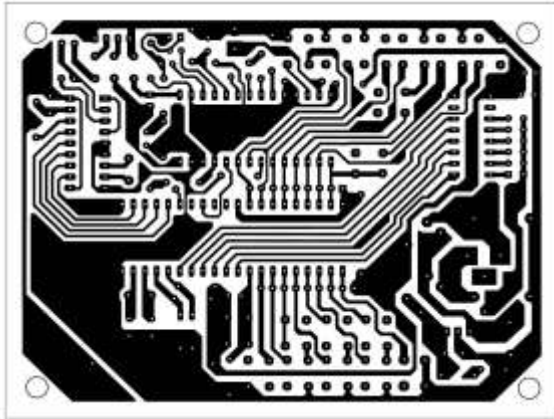


Fig.4 shows the single-side PCB for cell phone-based device control with voice acknowledgement.

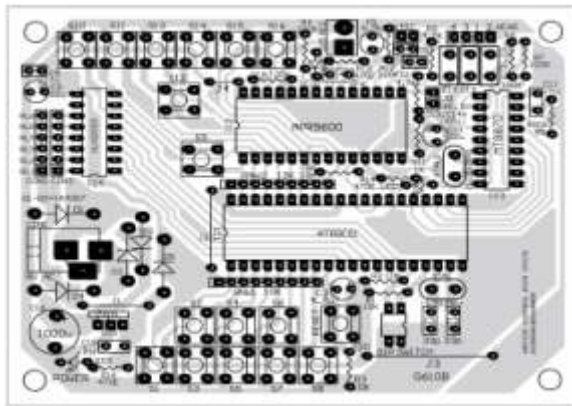


Fig.5 shows the component layout for cell phone-based device control with voice acknowledgement.

V. RESULT AND ANALYSIS

The project “Development of Cell-phone Based Device Control with Voice Acknowledgement” an effective switching system for controlling home and office appliances.” has been successfully designed and tested.

It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC’s and with the help of growing technology the project has been successfully implemented.

FUTURE SCOPE:

In this project we are monitoring and controlling the home appliances from remote places by using the mobile technology. This project can be further enhanced to the High voltage A.C Applications by changing the ratings of the Relay. By this we can control and monitoring the high speed induction motors as well as synchronous motors. This can be done in an economical way.

VI. CONCLUSION

The project “Development of Cell-phone Based Device Control with Voice Acknowledgement” an effective switching system for controlling home and office appliances. In this project we use several numbers of integrated circuits, network elements such as diodes, rectifiers, filters, resistors, capacitors, etc. In this project we use the microprocessor program based integrated circuit namely IC AT89C51 micro controller, APR9600 audio recording and playback device, MT8870 DTMF receiver, ULN2003 relay driver and other electrical and electronic components for the desired performance of this project.

VII. REFERENCES

- [1] Waldherr, S., Thrun, S., and Romero, R., “A Gesture based interface for Human-Robot Interaction”, Kluwer Academic Publishers, Netherland, 2000
- [2] Liu, T., Guo, H., and Wang, Y., “A new approach for color-based object recognition with fusion of color models”, Congress on Image and Signal Processing Conference, Sanya-China, vol. 3, pp. 456-460, May 2008.
- [3] Wang, B., and Yuan, T., “Traffic Police Gesture Recognition using Accelerometer”, IEEE SENSORS Conference, Lecce-Italy, pp. 1080-1083, Oct. 2008.
- [4] Lalanne, T., and Lempereur, C., “Color recognition with a camera: a supervised algorithm for classification”, IEEE Southwest Symposium on Image Analysis and Interpretation, Tucson-Arizona, pp. 198- 204, April 1998.
- [5] R. Sharma, K. Kumar, and S. Viq, “DTMF Based Remote Control System,” IEEE International Conference ICIT 2006, pp. 2380-2383, December 2006.
- [6] R.C. Luo, T.M. Chen, and C.C. Yih, “Intelligent autonomous mobile robot control through the Internet,” IEEE International Symposium ISIE 2000, vol. 1, pp. 6-11, December 2000.
- [7] G. Arangurenss, L. Nozal, A. Blazquez, and J. Arias, “Remote control of sensors and actuators by GSM”, IEEE 2002 28th Annual Conference of the Industrial Electronics Society IECON 02, vol. , 5-8 Nov. 2002, pp.2306 – 2310.
- [8] L. Schenker, "Pushbutton Calling with a Two- Group Voice-Frequency Code", The Bell System Technical Journal, 39(1), 1960, 235–255, ISSN 0005-8580.
- [9] P. Pradeep, M. Prabhakaran, B. Prakash, P. Arun Kumar, and G. Gopu, “Advanced Design for Robot in Mars Exploration,” presented at 2010 International Conference on Industrial Engineering and Operations Management Dhaka, Bangladesh, January 9 – 10, 2010.
- [10] T. Nguyen and L. G. Bushnell, “Feasibility Study of DTMF Communications for Robots,” Dept of EE, University of Washington Seattle WA, 98195-2500, April 6, 2004.

Authors:

[1]



Ujjwal Kumar Singh is a student doing his diploma in Electronics and Communication in Centre of Computers and Communications Technology, Chisopani, South Sikkim, India. His area of interest is in PCB, Microcontroller, Microprocessor, PLC, Advanced C, Radar and Fibre Optics.

[2]



Deepak Rasaily is presently associated with the Department of Electronics and Communication Engineering at Centre for Computer and Communication Technology (CCCT-Govt.Polytechnic) Chisopani, South Sikkim, India as a Senior Lecturer since 2003 to till date. He is ME-Scholar at National Institute of Technical Teachers' Training & Research, Chandigarh, India. He Worked as Project Scientist in the Department of Science and Technology, Govt.of Sikkim prior to Lecturer in CCCT. His areas of interest are PLC and Robotics, Microprocessors and Microcontroller and Digital Signal Processing.

[3]



Priyanka Rana , a student of CCCT Chisopani south Sikkim of final year in the course of Electronic and Communication Engineering. Her area of interest in many subjects of course like satellite & cellular communication ,Mathematics ,PLC ,Microcontroller and microprocessor.