Smart Home Microcontroller: Telephone Interfacing

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Outline

- **Introduction & Design Goals**

- **System Operation**

- **Design & Implementations**

- **Conclusion & Future Development**

Introduction & Design Goals

Introduction

- **A new low cost smart home system that would enable the user *to remotely activate or deactivate electronic home appliances* from a very long distance has been designed and developed -- PhoneTech.**

  — **The user can be at anywhere, and the phone can be any touch-tone phone or cell phone.**

  — **The basic idea of this project is to take advantage of the vast network of telephone lines and the proliferation of cell phones to extend human's reach and possibilities.**

  — **The system, through telephone networks, connects the user to home appliances at home and gives him/her the ability to switch them ON or OFF.**

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Design Goals (1)...

Specifications:

Inputs:

- Only 2 inputs. One is connected to the phone jack while another one is connected to an alarm indicator.

Outputs:

- The system controls multiple appliances; can be physically wired to the appliance or connected remotely, i.e. infrared connection or even through radio frequency.

- The system also offers a voice message for users ; these audio signals travel over the same phone line through which the input comes to the system.

- The system also communicates with the PC serially.

- Each action taken by the user will be kept track by the system and then recorded down by the PC.

- Then the system will acknowledge the user on the action taken through SMS. An auto-dialing feature is implemented to alert the user for emergency purposes.

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Design Goals …(2)

System Functionalities:

- Switch ON/OFF 2 electric appliances.

- Requires a four-digit password - to provide security to prevent breaking into the system.

- Allows the user to change password, ring detection count, and password attempt.

- Provide voice message to inform user of:
  — Menu options available.
  — Acknowledgment of data received.

- Record down the actions taken by user in PC.

- Send SMS to notify the actions taken.

- Auto-dialing for emergency purposes.

Power supply:

- The system used standard +5V and -5V DC.

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System Operations

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Operations (1)…

- **The user dials the home telephone number like an ordinary telephone call.**

- **The telephone at home rings and if nobody picks the call up to 3 rings (or any value set by user), then the system picks up the call.**

- **The system then asks for the password. The user enters the password and if no password is entered within a certain time, the system will hang up.**

- **Once the password is entered, the user will be offered a voice menu and asked to choose from that menu.**

- **The user chooses an item from the menu by pressing a button on the phone keypad.**

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Operations …(2)

- **Pressing a button on the phone generates a DTMF signal which, through the telephone network, will reach the system at home.**

- **The system will recognize the received signal and based on that will switch ON/OFF the chosen appliance either through a physical wiring connection, infrared or RF connection.**

- **The system transmits data serially to the PC so that the user will be able to keep track the call details made by the user.**

- **Then, the PC triggers the GSM mobile phone to send a SMS to the pre-defined telephone number in order to notify him/her the action taken on the system.**

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Design & Implementations

# Block Diagram of Whole System
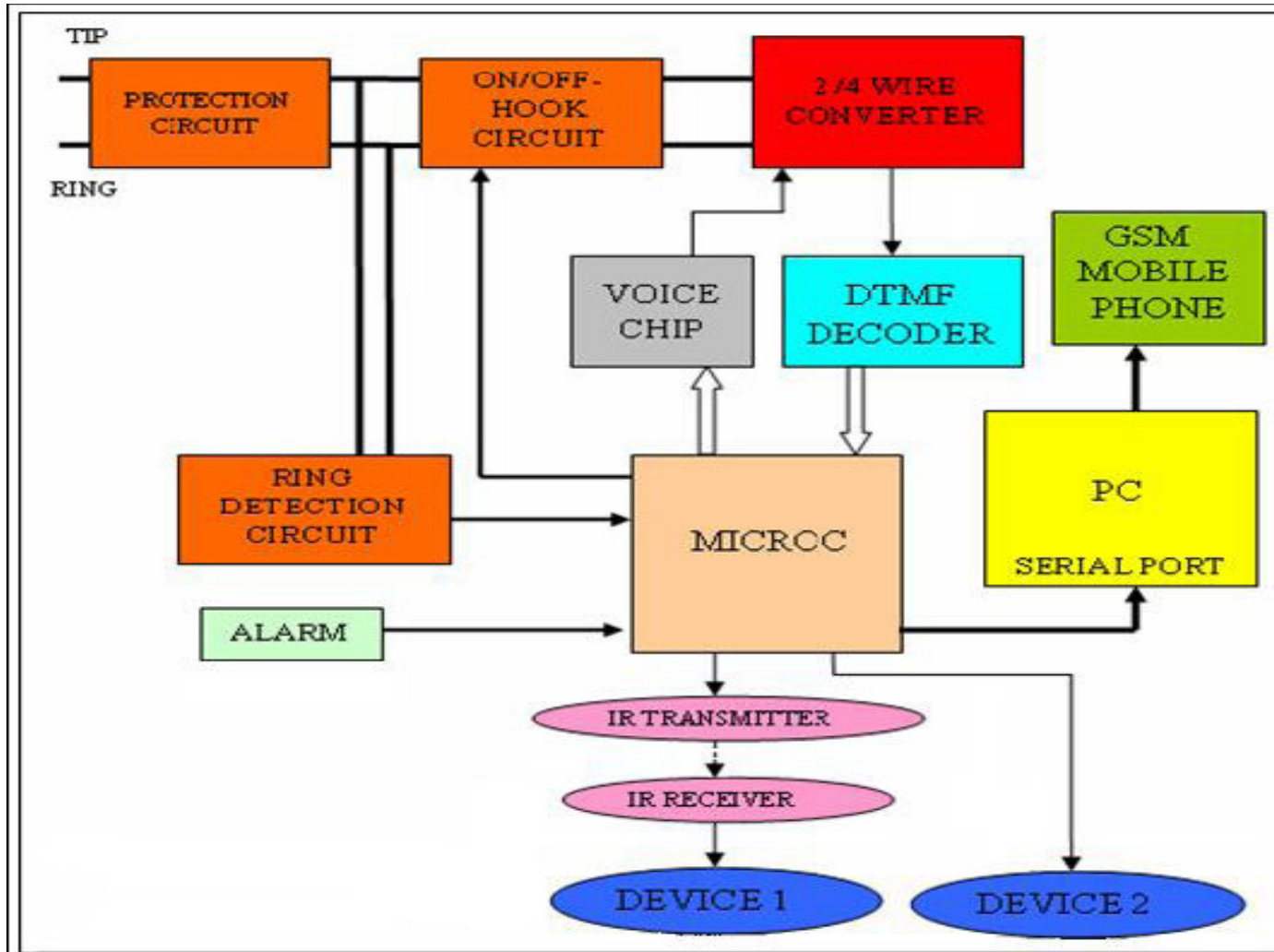
Block Description (1)...

Telephone Line Interfacing Circuit:

– **Protection circuit:**

Protect the system from telephone line transients.

– **Ring detection circuit:**

Detect incoming ringing signal. When **PhoneTech** is in On-Hook condition, the ring detection circuit is connected to the telephone line. Capacitor C1 is used to block DC to pass through opto-isolator, resistor R1 is used to limit the current passing through opto-isolator LED and the reverse.

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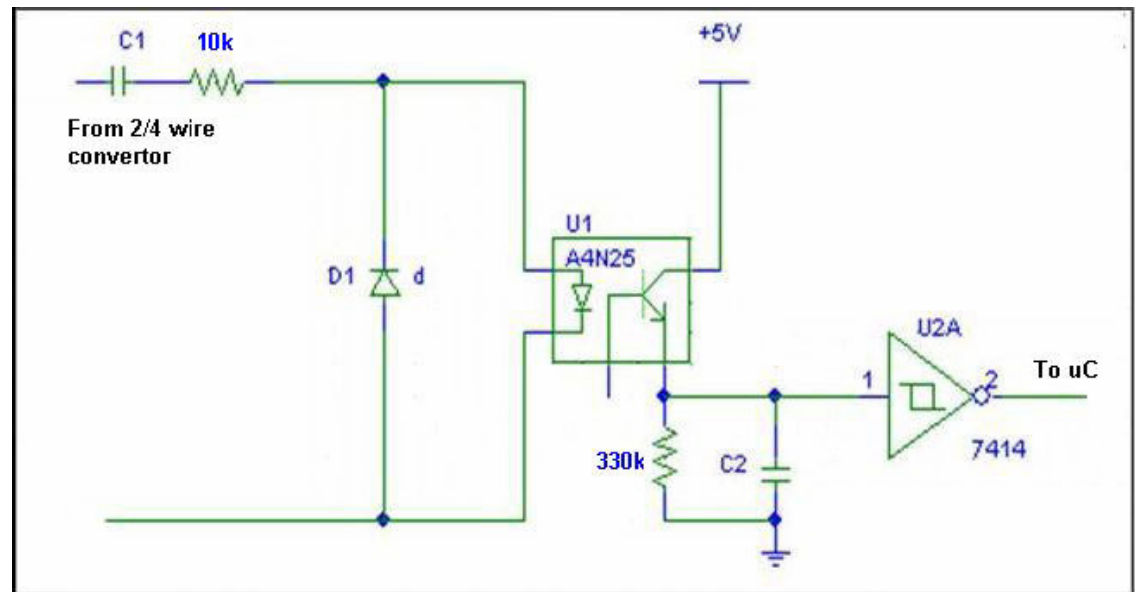
Block Description (2) ...

On/Off-Hook Circuit:

Pick up or hang up the call.

A Schmitt trigger which is controlled by the microcontroller is used to drive the LED of the opto-isolator ON which in turn energizes the relay switch and connects the telephone line to the system, while maintaining as a direct current loop signal to imitate the action of going off-hook.

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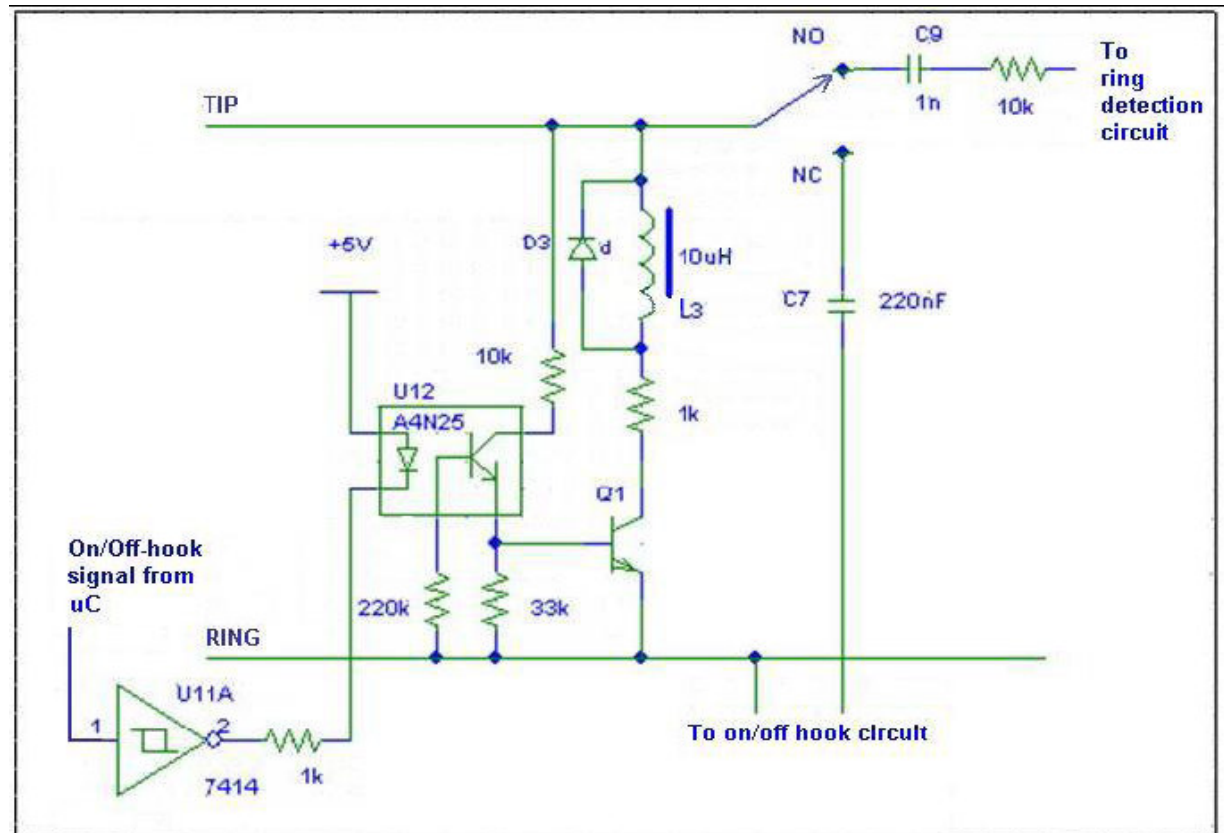
Block Description (3)…

2/4 wire converter:

Once Off-Hook, the telephone lines are connected to this circuit. It splits bidirectional audio from the balanced telephone line into separate single ended transmit and receive paths.
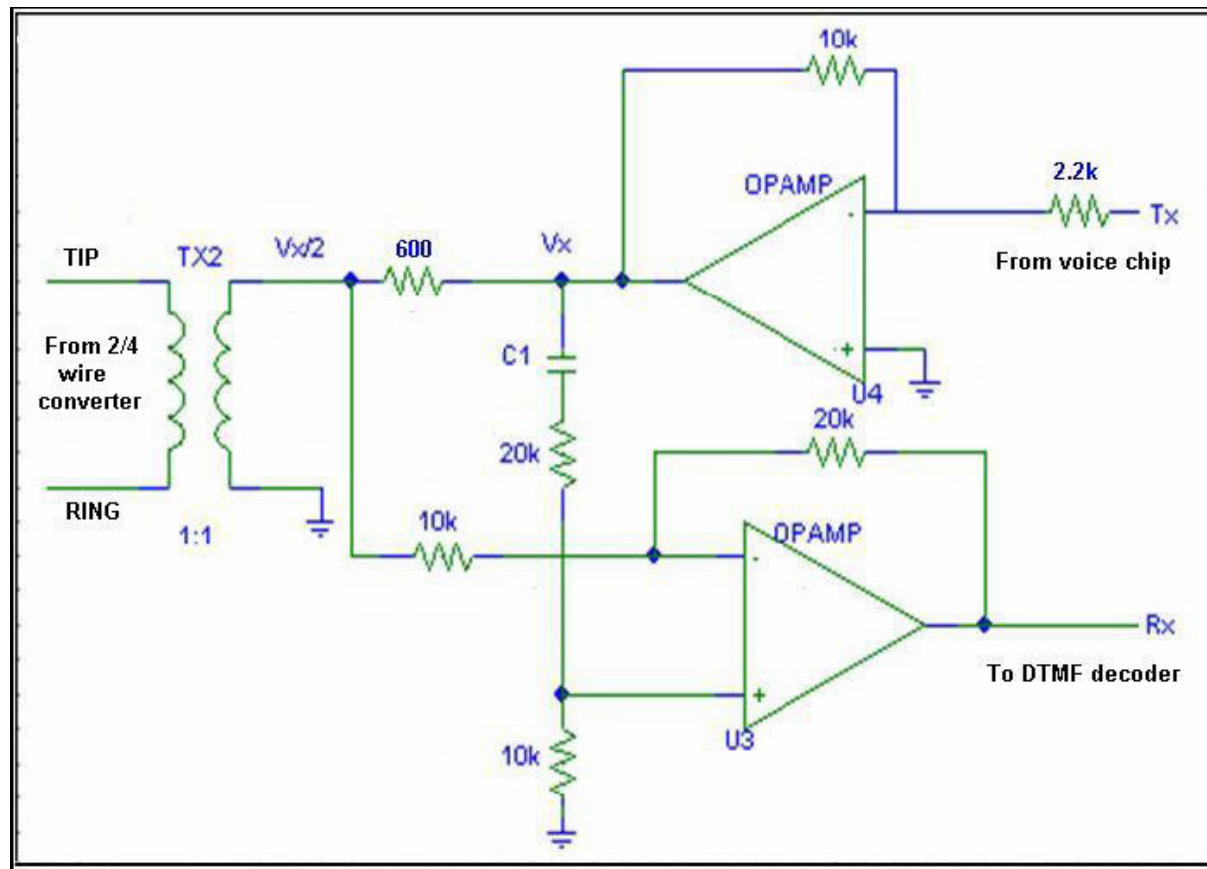
Block Description …(4)

DTMF Decoder:

Decode Dual-Tone Multiple Frequency (DTMF) signals from user and represents them in a sequence of four bits.

Voice Chip:

Play pre-recorded messages for users.

Microcontroller:

The microcontroller used in the system is Atmel AT89S51. It is an 8-bit microcontroller. Control all logic operations of the system.

IR Transmitter & Receiver:

Provide wireless remote control feature.

PC (Personal Computer):

Communicate serially with the system to display call details on monitor. Originate the sending of SMS and auto-dialing.

GSM Mobile Phone:

GSM modem to send SMS and performs auto-dialing.

Alarm:

Input from alarm whenever the alarm is triggered and the system will perform auto-calling to alert the user.

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Conclusion
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Future Development

Conclusion

- We have presented a new smart home telephone system, **PhoneTech** which was designed to overcome the limitation of distance faced by normal remote control.

- This system is simple and is based on the telephone function that most house owners are familiar with.

- **PhoneTech** has the features of automatic Off-Hook, security password, voice prompting, infrared remote control, system-PC interfacing, SMS notification and auto-dialing during emergency..

- This low cost system, which is just based on an 8-bit microcontroller, will be the every household device in future. The application of this remote control system will grow as the number of phones and particularly cell phone users grow around the world.

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Future Development

This system can be further developed to provide better home automation and data communications. Also, it can be enhanced in a number of ways depending on the applications:

- **Caller ID**
  - let the user know who is calling before picking up the phone
  - the phone number and caller's name can be displayed on the PC monitor

- **Family message center**
  - at the remote end messages consists of ASCII characters are entered from a telephone keypad

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