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# SMS over PSTN Using DTMF Signaling

**Batch - B5**

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**Abstract**

In the past decade, Short Service Message (SMS) has become very popular. The usefulness of SMS lies in the fact that the user can view the message at his convenience. Until now, SMS has been confined only to wireless mobile communication. There is an increasing need to add SMS capability to landline phones that work on Public Switching Telephone Network (PSTN). In this report, we present how that can be achieved using a microcontroller (89C52) and a DTMF Transceiver IC (CMX860). We used JHD162A (Intelligent LCD) to display the message. We used TEA1062A IC as hybrid to interface the 2-wire telephone line to 4-lines of CMX860 IC.

## Introduction

Telephone lines are capable of carrying signals in the bandwidth of 0 to 4 kHz. It is possible to send digital data (binary) by using just two frequencies. We are using 1300 Hz for 1 and 2100 Hz for 0. We propose to store the data in digital form in the RAM of microcontroller and send it to the SMS server over the telephone lines.

The project can be divided into three parts, namely

**(a). Message input, display and storage**

**(b). Interfacing microcontroller with DTMF transceiver for message transmission and reception**

**(c). Interfacing 4-line transmission and reception of DTMF transceiver with 2 wire telephone lines**

The block diagram of the project is shown in Fig. 1

A relay is used between telephone lines and the telephone. Microcontroller controls the relay and it disconnects the telephone from the telephone line if the incoming signal is detected as message. So the telephone rings for sometime before deciding if the incoming signal is a message or a voice call.

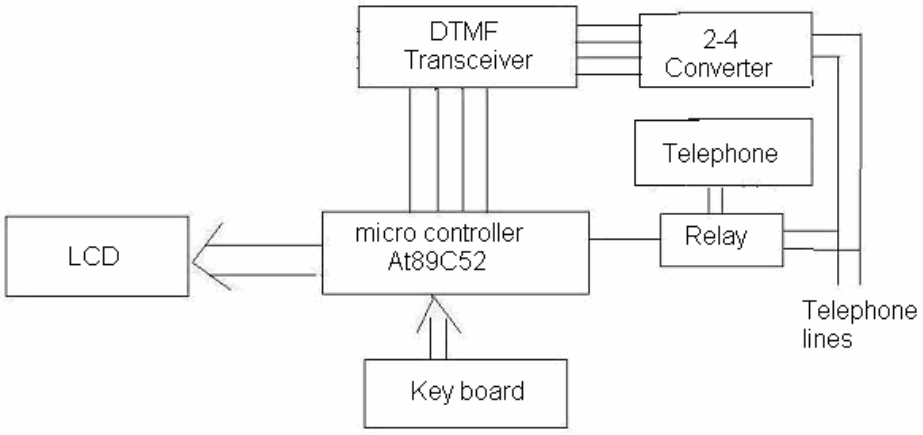



Fig.1: Block diagram

**a) Message input, display and storage:-**

This part includes a keyboard to input the message and the destination number and intelligent LCD to display the message. Both the keyboard and LCD are controlled by the microcontroller, AT89C52. External interrupt 0 is used to indicate the pressing of a key. Port 1 is interfaced to keyboard and Port 2 is interfaced to LCD. The message typed is simultaneously displayed on the LCD and stored as ASCII values in the RAM of the microcontroller. The destination telephone number to which message is to be sent is also stored as part of the message. The service centre to which the message along with the destination number is to be sent is fixed.

**b) Transmission and reception of message:-**

The message stored in ASCII form is transmitted serially by FSK using Telephone signaling transceiver IC (CMX 860). The IC operates with 11.0592MHz oscillator crystal. It needs two DC supplies, one for digital signal level (DVdd) and another for analog signal level (AVdd), that is transmitted and received on the telephone lines. The correct operation of the IC can be checked from the voltage at pin 15 (Vbias) which will be approximately at DVdd/2 except in power save mode. The IC is controlled by the microcontroller. The IC has serial interface with the microcontroller. The serial interface of the microcontroller operates in synchronous mode. The frequency of the serial clock is 1MHz. Whenever data transfer begins, the IC select pin (CSN-pin 23) is taken low and is kept low till the completion of the data transfer. The interrupt pin (IRQN-pin 27) is connected to external interrupt 1 of the microcontroller. When the message and the destination number are given, the microcontroller first gives command to CMX 860 to dial the number corresponding to the service centre, which is fixed using DTMF tones. Then, the IC is programmed by microcontroller to operate in FSK transmission mode. The IC then transmits continuous 1's for some time (<65ms) on the line to make sure that the communication to the service center is established. Each ASCII byte of the message is transmitted serially from the microcontroller to the IC. The IC transmits the input byte on its output lines using FSK (Frequency Switched Keying). A start bit and stop bit are added to each byte. No parity bit is added. The frequency corresponding to '0' is 2100Hz and that corresponding to '1' is 1300Hz. The baud rate of

transmission is 1200bps. After the end of transmission of the message, the IC transmits continuous 1's for some time (>65ms) to indicate the end of the data transfer. The IC then disconnects from the line.

When the service center transmits a message, it first dials the destination telephone number. The destination telephone rings. The ring detector circuit connected to the IC CMX860 will cause an interrupt to occur at the pin IRQN which is connected to the external interrupt 1 of the microcontroller. The microcontroller programs the IC in FSK demodulator mode. If there are continuous 1s on the line, the incoming call is a message transfer and the relay is disabled. Otherwise, the incoming call is a voice call and the telephone is allowed to ring. If the incoming signal is a message call, it programs the IC in start-stop mode and waits for data to arrive. If the data doesn't arrive in a timeout (65ms), there is supposed to be an error in the transfer and the microcontroller ignores the call and terminates the connection. The IC receives and transfers each byte to the microcontroller. The IC operates in this mode till there are continuous 1s for some time(65ms) or there is no signal on the line. After this is noted, the microcontroller disables the receiver of the IC and displays the received message.

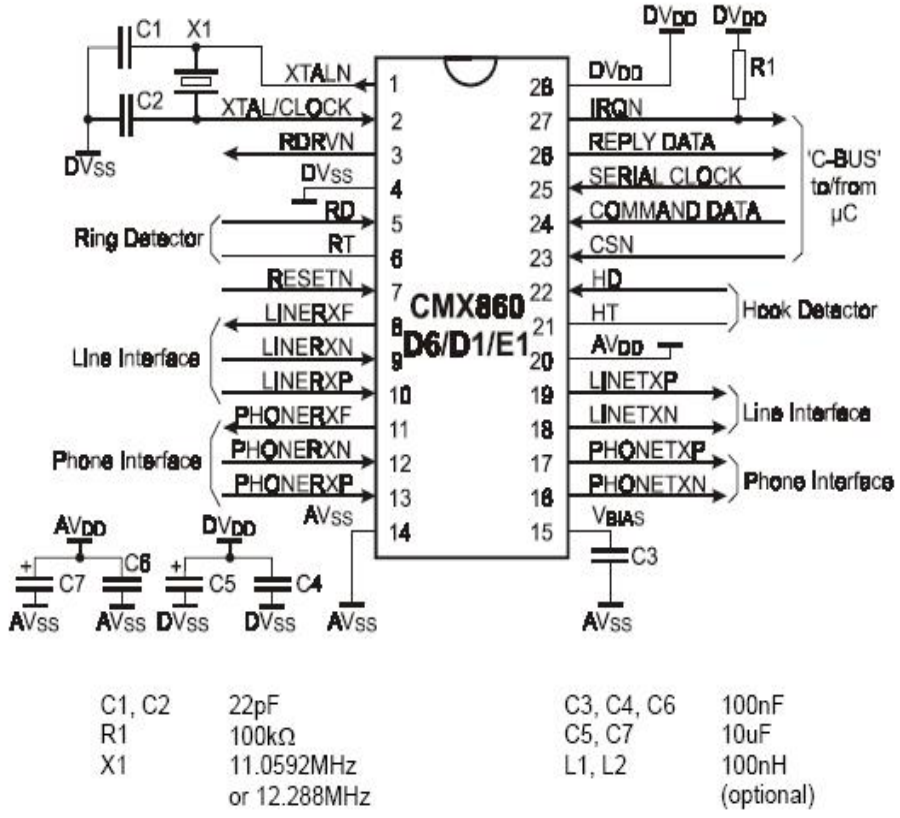



**Fig. 2 External circuitry of CMX860 IC**

## c) Interfacing 4-line transmission and reception of DTMF transceiver with 2 wire telephone lines

For this module TEA1062 is used for a low voltage FSK modulated signal transmission circuit with the dialer interface. The TEA1062 is integrated circuit that performs all speech and line interface functions required in fully electronic telephone sets. They perform electronic switching between dialing and speech. It has DTMF signal input for dialing. On Hook/Off Hook status of the dialing circuit is controlled by the relay drive pin (RDRVN) of the IC CMX 860. When this is low, the telephone is off hook and when it is high, it is on hook.

The circuit diagram of the line interfacing part is shown in fig 3. In this circuit, the signal to be transmitted from the IC CMX 860 is input at MIC- and MIC+ (pins 6 and 7). The

MUTE input is kept high so that DTMF transmission also takes place through the CMX IC only.

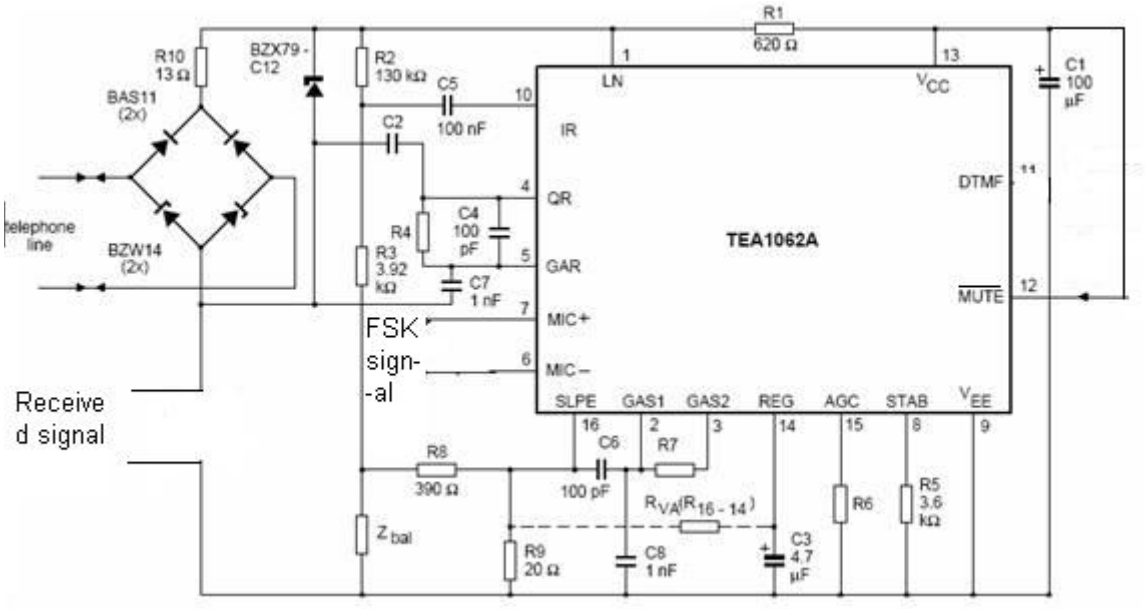



**Fig. 3 Circuit diagram for telephone line interfacing part with TEA1062A**

For adjusting gains for transmitted signal and receiving amplifier input of the line interfacing circuit following parameters are chosen.

$R_{VA}$ = 39 kΩ

$R_4$ = 100 kΩ

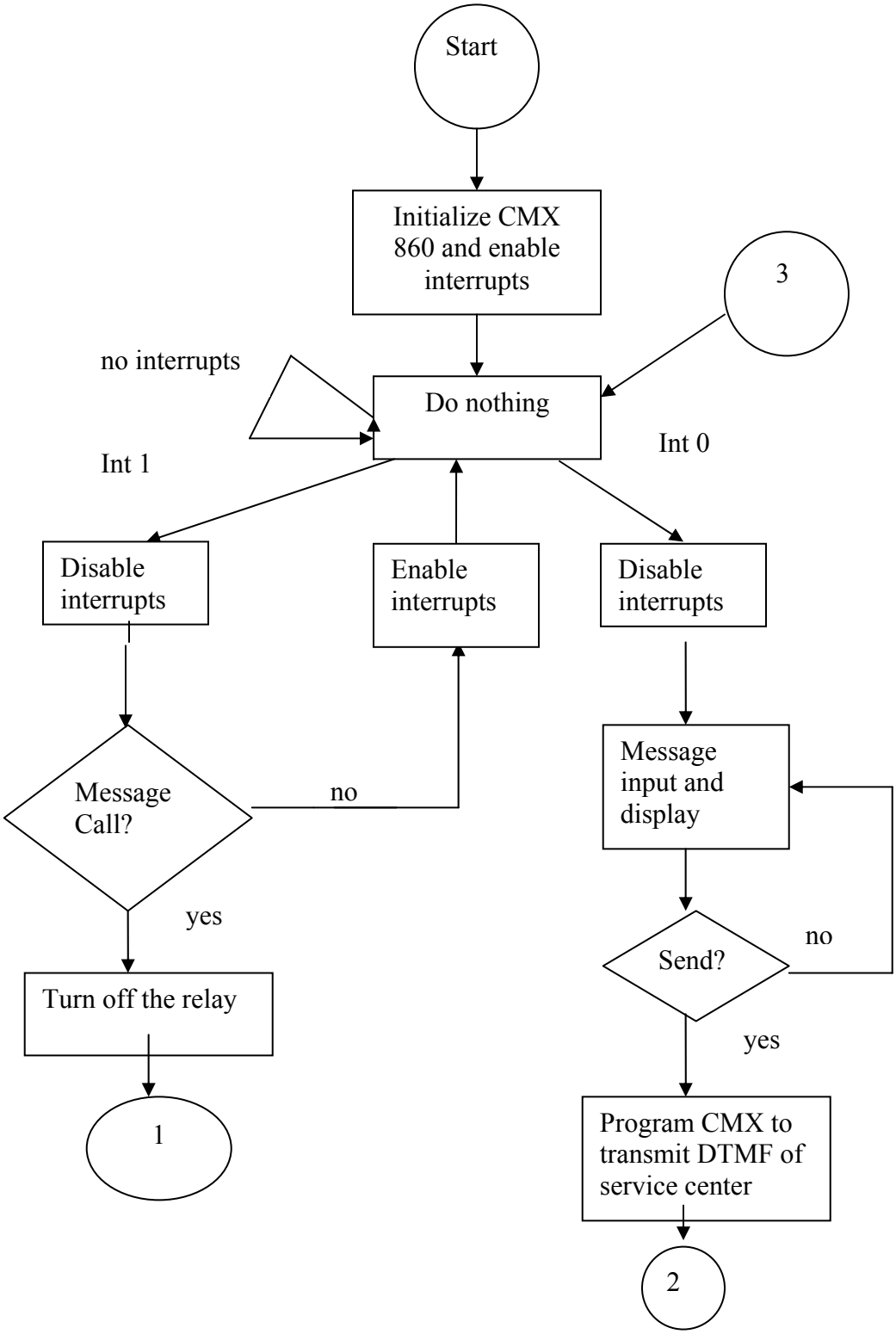
$R_6$ = 110 kΩ

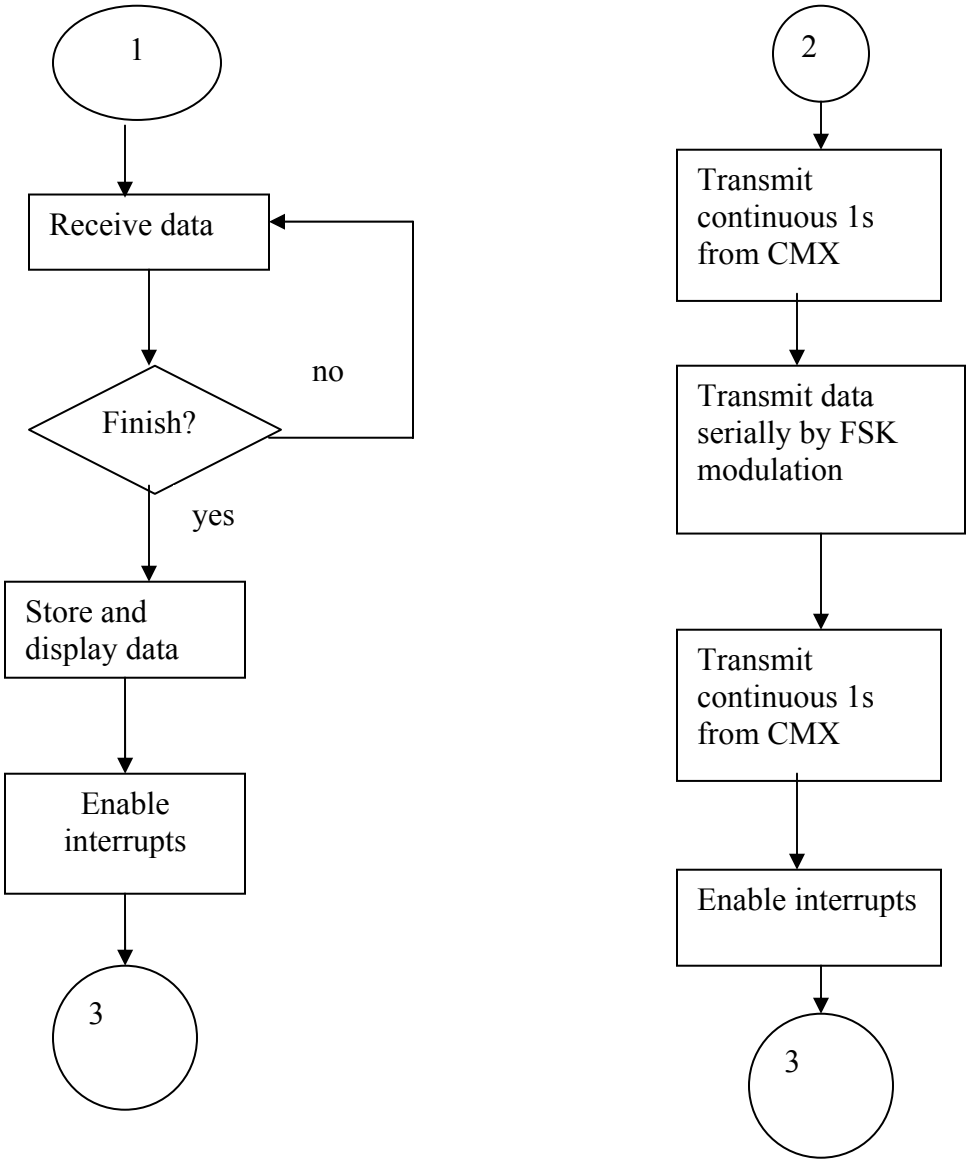
$R_7$ = 68 kΩ

$Z_{bal}$ = 130 Ω + (830 Ω || 220 nF)

The algorithm executing at the microcontroller is given in next page.

**Flow chart of the algorithm at the microcontroller:-**






## Conclusions and Future Work

The work in part (a) is completed. The keys typed on the keyboard are simultaneously stored in the RAM and displayed on the LCD. We are able to interface CMX 860 to microcontroller. We are able to send and receive FSK modulated data from the server (made by batch – B8) using 4 line connection. We can extend this to telephone lines by using a hybrid (device to convert two-wire signal to four-wire signal and vice-

versa). We have observed that the required level of anti-side tone suppression could not be achieved using TEA1062A. So we are doing half duplex communication.

## REFERENCES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