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Data Transmission in Wireless Modem for Hardware Section

Ankur Singh and Jasvir Singh
Department of Electronics Technology, Guru Nanak Dev University, Amritsar, Punjab, India

Abstract: A wireless personal area's networks are short range communication system providing connectivity between consumer electronics and communication electronics devices. Due to increasing exchange of data in servicing as e-mail, internet, there is a need for an increase in data through put. High data rates is required for time depended and large file transfer applications such as high quality video, multimega bit file transfer for music or user might wants to stream movies for his personal computer for high definition without scribing the requirement of low complexity and flow power consumption. Wireless modems are devices that allow computer to connect to a wireless local area network without physical cabling such as Ethernet wiring. The present study deals with development of power supply and transmitter section of wireless modem.

Key words: Data transmission, wirless modem, hardware section, net work

INTRODUCTION

Wireless modem is an entirely new concept. The conventional modem is an essential part of today's computer communication. Still, it poses lots of problems. The modem is entirely dependent upon telephone lines for communication. Busy telephone lines and line faults always pose a major problem for a computer professional. The lack of telephone lines, nonexistence of telephone lines at certain inaccessible areas such as hills, marshes etc. eliminates the only scope of computer communication. Also the limited bandwidth of telephone lines limits the maximum rate of transmission of data that can be attained by modem. The use of modem is hence putting more load on already overloaded existing telephone lines.

Considering the problems imposed by conventional modems, the concept of wireless modem promises a relief from all such problem. The wireless modem which transmits and receives data in RF band thus eliminating the need of telephone lines totally. Since it communicates in RF band whose bandwidth is considerably larger than that of telephone lines, we can attain larger throughput while transmitting or receiving data as compared to that obtained by using telephone lines. Remote use of these modems allows their use in inaccessible areas where cable lying is difficult.

Wireless Modem is a peripheral device which enables computers to communicate with each other over RF band.' Wireless Modem 'stands for wireless modulator/demodulator. The purpose of wireless modem is to modulate the digital signal, that a computer understands, into an analog signal that can be carried over RF band and demodulate it to recover back original digital signal at the receiving end[1,2].

Modulation technique used in the present study: FSK is the modulation technique used in this wireless modem. This modulation technique uses one tone to represent '0' and another tone to represent '1' i.e., called space and mark frequencies respectively. Range of wireless FSK modem: 1070-1270 Hz. Two frequencies are required, one for each direction of transmission. Four frequencies permit simultaneous sending and receiving of data within two channel. One channel is 300 to 1700 Hz and 1700 to 3000 Hz[3,4]. The above waveforms shows how the carrier signal is modulated by the digitally modulating signal (zeros and ones). For Logic zero frequency is same as the carrier frequency but for Logic one frequency is not same as the carrier frequency. It is changed in proportion to the modulating signal. Mathematical treatment is given be

$$V_{fsk}(t) = V_c \cos [2\pi [f_c+v_m(t)\,\Delta f]t]$$

Where $V_{fsk}(t)$ = Binary FSK waveform
V_c = Peak analog carrier amplitude (volts)
F_c = Analog carrier center frequency (hertz)
Δf = Peak change in the analog carrier frequency
$V_m(t)$ = binary input signal
$V_m(t)$ = -1 for logic low level

$$V_{fsk}(t) = V_c \cos[2Đ[f_c-\Delta f]t]$$

$V_m(t)$ = 1 for logic high; $V_{fsk}(t) = V_c \cos [2\pi [f_c+\Delta f]t]$

Coresopnding Author: Ankur Singh, Departmentt of Electronics Technology, Guru Nanak Dev University, Amritsar, Punjab, India

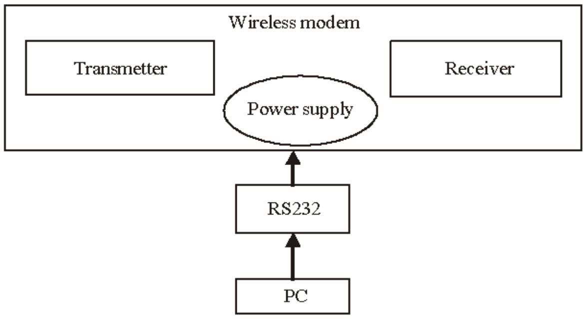


Fig. 1: Block diagram of the system

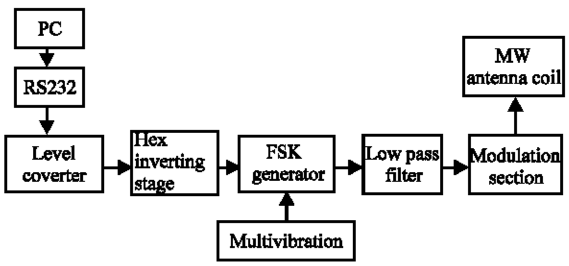


Fig. 2: Block diagram for trasmiter section of wirless modem

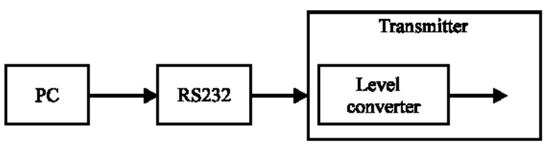


Fig. 3: Interfacing of PC with level converter of transmitter section via RS232C

Thus we have seen from above equations that for logic 0 Frequency of carrier remains same but it is changed by factor Δf for logic 1 of the modulating signal. The Fig. 1 shows the block diagram of the wireless modem.

Transmitter section: The transmitter section of the wireless modem is shown (Fig. 2).

The detail of the IC's used and electronic components used in the present study will be provided in subsequent pages. IC 75189 is used as a level converter for interfacing RS232 cable from the PC to the transmitter section (Fig. 3):

WORKING

Before we go on to describe the functioning of the modem, the RS-232 port of the computer should be described first. RS-232C:It is a port available on PCs by the names of COM1, COM2------etc.This port is named after the protocol, which it implements. The level of signal on these lines are of magnitude±12V.The above diagrams tell us how the serial data sent by USART in the computer via TTL to RS232C level convertor, is converted from TTL level toRS232C level. The logic HIGH (5V) is converted into-12 V and logic low (0V) is converted into+12V.In this way the TTL to RS232C converter converts the data sent to it by theUSART into RS232C level.

Transmitter section: The transmitter of computer can be divided into three sections, which are described as follows:

RS232C to TTL LEVEL CONVERTOR: Though in the initial design we had planned to use IC 1489 for this purpose, but we had to switch to IC75189 due to the non availability of IC1489.IC 75189 is direct pin to pin and is electrically compatible to IC 1489, so using this IC does not impose any problem. Only gate G_1 of this IC is used. The data output from the serial port of computer is converted into TTL level by this gate, which can be used by other TTL IC's on board in this modem. This section gives low when USART gives HIGH and viceversa.

As shown above the input data from the computer which is taken from the RS232 cable is first converted to TTL logic levels so that two logic can be easily implemented on the hardware portion. Actually the output data stream from the cable has logic'1' level be-10V and logic'0' level be+10V. So this data stream is given to the level converter to bring these logic levels to 0V and 5V respectively. Now next these logic levels are given to the Hex inverter to complement the logic levels so as to bring the logic'1' to +5V and logic'0' to 0V. This block contains NOT Logic gate.

FSK generator: This section converts the serial data (TTL level) into a form that is expected by the transmitter section of modem. The FSK method is employed in doing so. In this method, different levels of input signal are represented by different frequencies. Here HIGH level (5V) is represented by 2500 Hz and logic LOW is represented by 1250 Hz.This section consists of gates I_1, I2, I3 of IC 7404 and IC 7476.The gate I_1 inverts the signal given out by G_1, which is given to IC7476.Gates I_1 and I_2 are used as free running oscillators which provides 5Khz clock to IC7476.The variable resistance is calibrated to give 5Khz.The IC 7476 consists of independent J-K flip-flops with presets. Now the description of the functioning of IC is to be done by taking different cases of input (from I_1).

Case 1: Input is high i.e., 5V.The preset as well as J-K inputs of FF1 are logic HIGH. When Jand K inputs are HIGH together, the J and K flip flop toggles on every position of clock input. This when input is zero; the FF1 gives 2500 Khz at its Qoutput.Now the clock of FF2 is permanently tied to +5V through 1.5 K résistance. The output of FF2 is used to change the state of J-K inputs of FF2.So whenever the output of FF1 is HIGH, the FF2 toggles and when output of FF1 is LOW then FF2 is reset to initial state of Q = 0 and Q = 1. Thus we see that FF2 effectively divides the output of FF1.Thus we see that logic HIGH 1250 Hz is generated by the FSK generator.

Case 2: Input is zero. i.e., 0V.By following the truth table and applying logic we can easily see that a signal of 2500 Hz is generated in this case.

After reading this, it is concluded that the logic 1(output of USART in the computer) is converted into 2.5 Khz signal and logic zero to1250 Hz signal.

So here in the FSK Generator section, Logic'0' is from the last stage is converted to a frequency of 2500 Hz and Logic 1 from inverting stage to a frequency of 1250 Hz. Thus we have seen that logic 1 from computer is converted to frequency of 2500 Hz and vice-versa.

Modulator section: This section comprises of a transistor, a medium wave antenna coil, gangue capacitor and few other passive components. This transistor is used as an LCoscillatorand the above-generated frequencies modulate the carrier signal, which is generated by the LC oscillator, which oscillates in the range of 550 to 1650 KHz (MW range). This section modulates the output signal (FF1 generator output) with the carrier and we get RFoutput, which is transmitted by antenna coil. So the generated carrier waves at two different frequencies (one for logic 1 and another for logic 0) are transmitted into RF band using medium wave antenna coil.

Power supply: AC power supply is given to the step-down transformer. Then output of the transformer is given to the bridge diode rectifier circuit to convert to the DC voltage. The output from the bridge circuit is given to the voltage regulators to get pure 12V and 5V DC supply at output (Fig. 4).

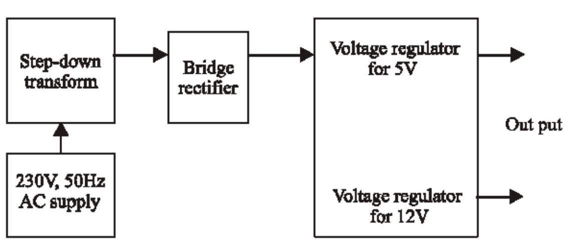


Fig 4: Block diagram of power supply

CIRCUIT DIAGRAMS

The Fig. 5 and 6 shows the circuit diagram of the wireless modem.

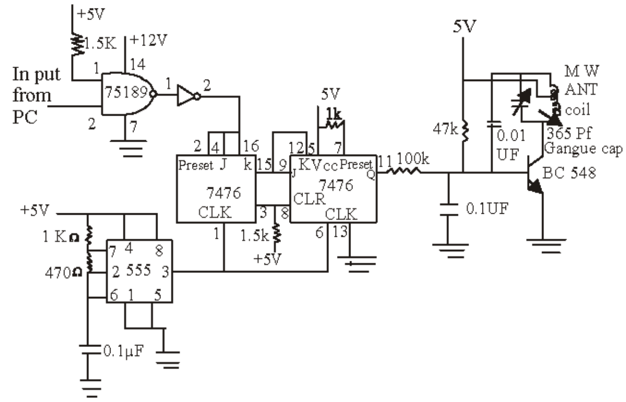


Fig. 5: Transmitter section

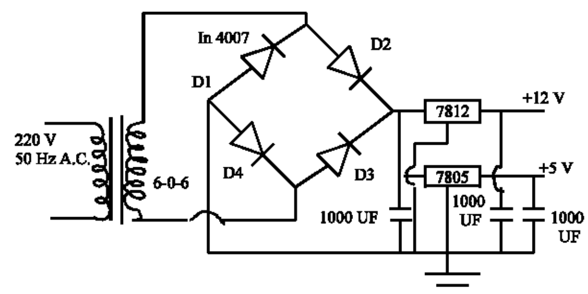


Fig. 6: Power supply

PCB FABRICATION LAYOUT

This section consists of the detail of testing phase of different parts of the wireless modem along with their PCB Layout.

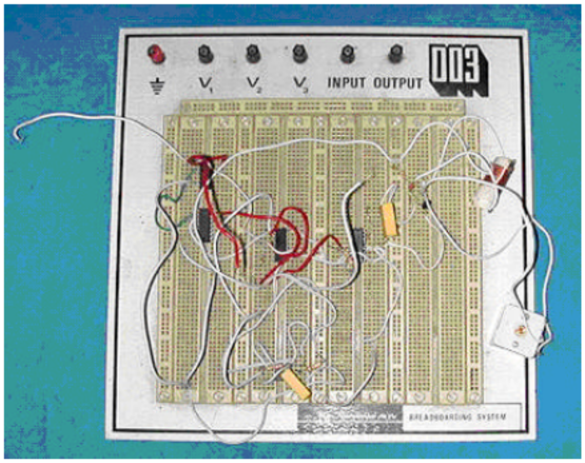
Testing phase: In testing phase, first the circuit components are connected on the breadboard for testing, the working of each component. All IC's are connected through the single standard wire. Two methods for testing the circuit are used:

Led testing: In this method voltages are tested at the output of every circuit component. LED of the rating 5V is taken for this purpose.

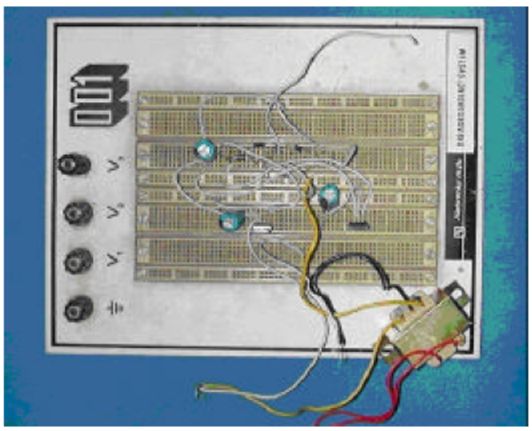
CRO testing: In this method, waveforms are seen on the output of each component. Also the voltage waveform at the transmitting end, i.e., at medium wave antenna coil is also taken.

The photographs of transmitter and power supply of the wireless modem under the testing phase have been shown in the subsequent pages.

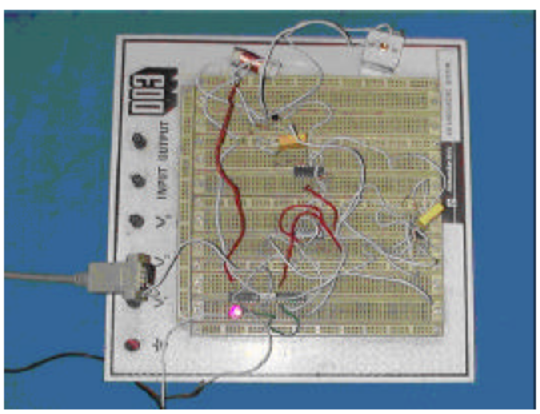
PCB layout: The PCB layout of the transmitter, receiver and power supply is shown above. This PCB layout is designed by using special *Express PCB design software*



Photograph of transmitter section



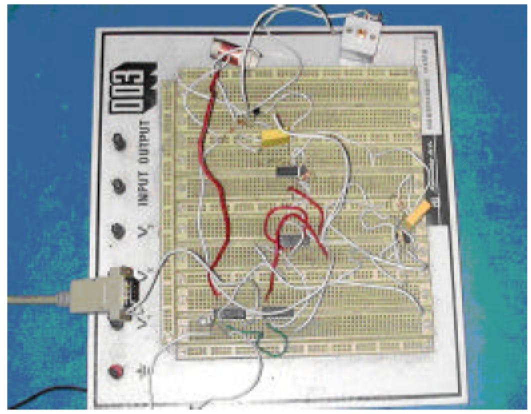
Photograph of power supply



Photograph of transmitter section interfaced with computer via RS232C with led glowing when data not transmitted

This PCB layout is single sided PCB layout. The Fig. 7 shows the PCB Layout, as given below.

The software development for interfacing data from PC to the level converter of the transmitter section of



Photograph of transmitter section interfaced with computer via RS232C with led not glowing when data is not transmitted

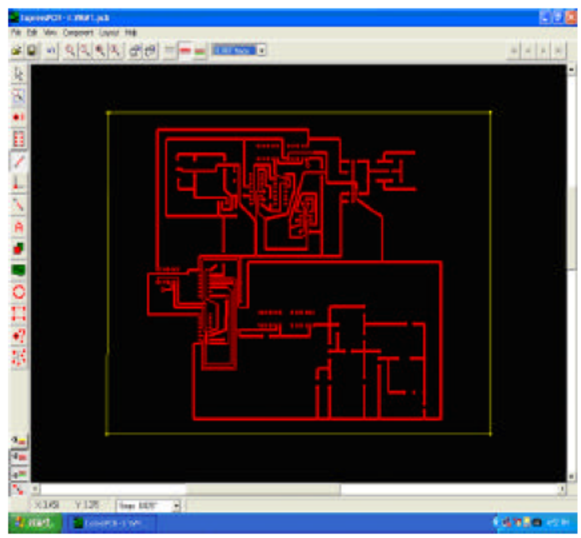


Fig. 7. The PCB layout of the transmitter.

wireless modem using RS232 cable has been successfully achieved[5]. The study is in the progress for advanced hardware and software development for wireless modem.

CONCLUSION

The Circuit of the Power supply and transmitter section of wireless modem was checked on bread board. PCB layout was designed with the help of the express PCB Software. The transmitter section was tested using LED. Interface with PC using RS 232 Cable has been done.

REFERENCES

1. Peter Davis, 1990. Wireless Local Area network technologies, McGrawhill publication.

2. Andrew, S. Tanenbaum, 2001. Computer Network. PHI India LTD.
3. http://standertsieee.org.
4. Rappaport, T.S.,1996. Wireless Communication Principle and Practices. Upper saddle river,NJ, USA.
5. Ankur Singh, 2006. Software Implementation of Wireless Modem Using RS 232 Cable. Presented at National level technical symposium, DAV Institute of Engineering and Technology, Jalandher, Punjab, India, pp: 4-5.