Design and Development of FSK Based Wireless Communication System for Remote Switching

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Abstract- A simple and low cost wireless transmission system has been designed and developed. Digital signals in the form of binary digits (bits) are chosen for wireless transmission using FSK technique. Signals are software generated and passed through the parallel port of a computer. A sophisticated FM transmitter is also designed and implemented for faithful transmission. A simulation of the hardware design is done to know the transmitting frequency and a standard commercial receiver has been tuned to detect the signal. The receiver tuned frequency matches with the simulated frequency signifying that the implemented system is efficient for wireless communication.

Index Terms— FSK, Wireless, FM, Transmitter

The demand for wireless communication products is growing very fast [1]. Wireless services which are existing today and planned for the future cover a bewildering range of applications, each of which requires solving a unique set of problems. Now a days, computerized control systems are also getting popular and useful to solve many problems [2]. Personal computers (PC) can be involved in many aspects of daily life to make the things easy and efficient and less expensive.

It has been observed that in different organizations especially in universities lights, fans and air conditioners are not properly run. Enormous misuse is encountered causing a huge amount of power wastage and damage of many appliances due to over use. In the universities the students do not OFF the lights, fans and air conditioners after the class is over and when they leave the classes. If an automatic computerized system could be deployed for switching control according to class schedule or necessity of an organization the situation could be handled properly.

The present work is intended to develop a system that can help us to control (ON or OFF) electrical appliances in a building automatically. This requires only one PC and an operator to control the lights, fans, air conditioners, and other electrical appliances. The salient feature of this work is that the switch control commands are sent by wireless transmission that eliminates the extra wiring hazard for the control network throughout the building.

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2 SYSTEM DESIGN AND RESULT

Since the input is digital so at first it is necessary to convert the digital signal into analog signal. Here two different signals binary '1' and '0' are generated by computer and then these digital data are converted into analog signals by a FSK unit [3]. LPT port of the computer is activated for sending the computer generated bits to the FSK unit [4, 5]. For completing this task a program with C++ language is developed to produce binary '1' and '0' signal at the output port of the computer. The inputs are given from keyboard as '0' or '1' (binary '1' and '0') and the corresponding output is available at the LPT port. This output is then given to the FSK circuit to convert it into analog signal as mentioned earlier.

Figure 1 shows the block diagram of the transmission unit. According to Fig. 1 the PC generates binary control signals through parallel port and passes it to the input of the FSK generator. Detail of the FSK circuit diagram is shown in Fig.2. The FSK generator unit is constructed using discrete components and simulation is done to produce desired output frequencies.

Instead of large number of device control a small prototype system is developed that can control only two devices named device 1 and device 2. Three combinations of two bit binary signals are generated (01, 00, 10) to perform the state change operation. 01 is the stable state that keeps a device continuously either in ON or OFF state. To toggle the switching (From ON to OFF or from OFF to ON) the binary control signal is changed from 01 to 00 (Device 1) and from 01 to 10 (Device 2) for a short interval (400 mS) and return back to its stable state. These binary control signals are encoded to three different frequencies (800 Hz for 01, 700 Hz for 00 and 900Hz for 10) by a frequency generator using FSK technique. These signal patterns are shown in Fig. 3

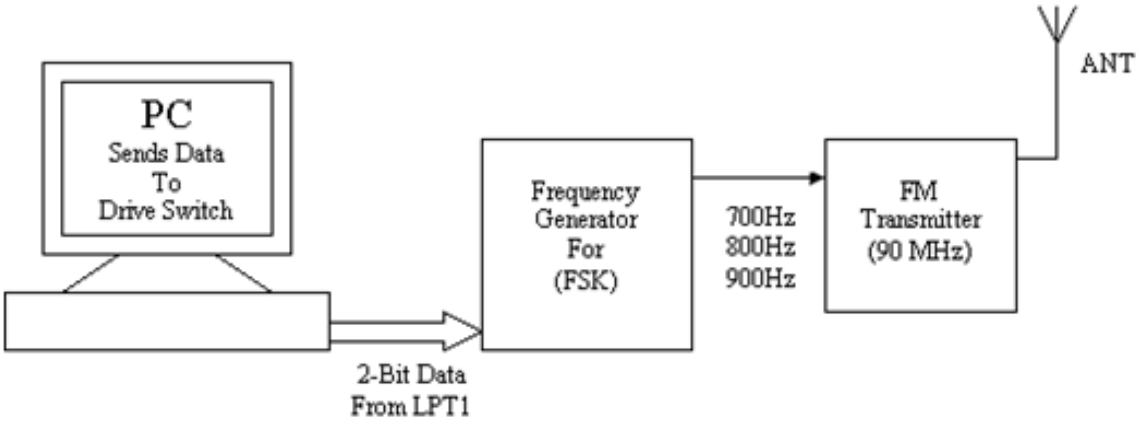

Fig.1: Block diagram of the transmission unit

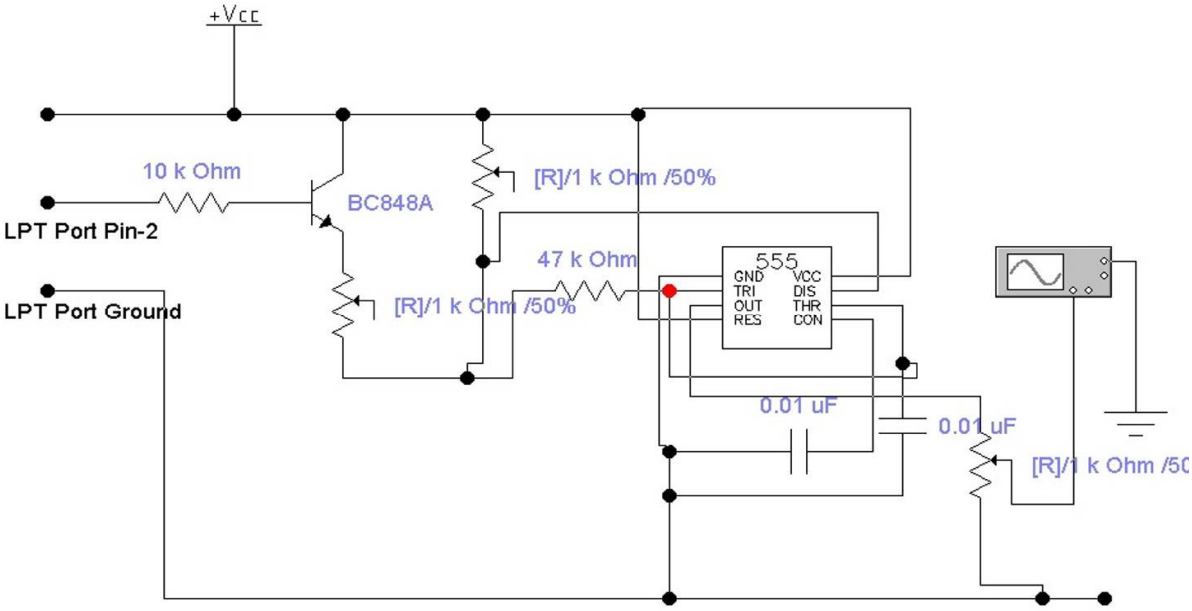

Fig.2: Circuit diagram of the FSK unit

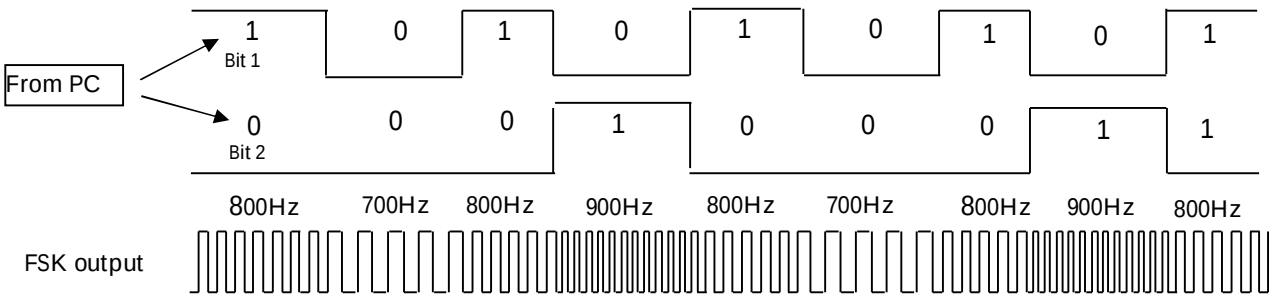

Fig. 3: Waveforms of computer generated bits and FSK output

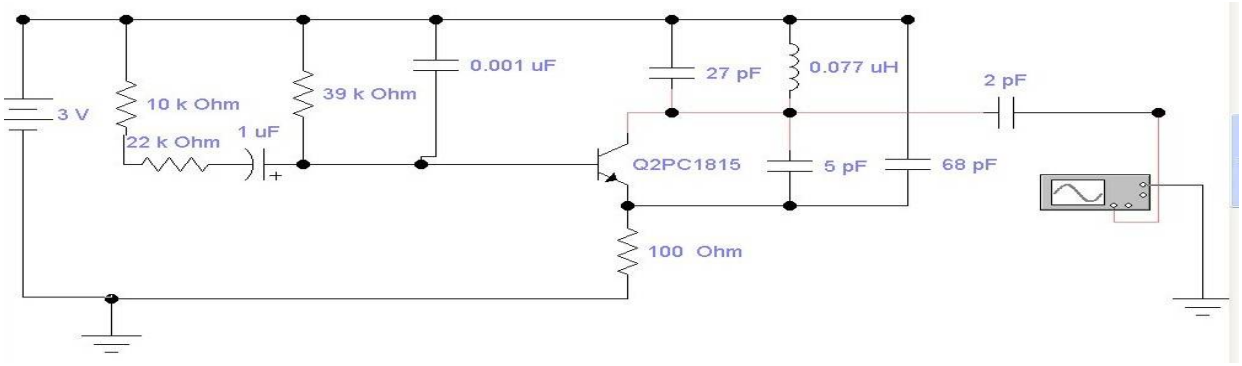

Fig.4: Circuit diagram of FM unit

FSK's outputs could be directly transmitted through the antenna but that would modulate the input (700 Hz, 800 Hz and 900 Hz) with the carrier frequency 90 MHz and then the modulated signal is transmitted [6]. The circuit diagram of the FM unit is shown in Fig.4. The performance of the oscillator part of the FM circuit is studied by using simulation software (Electronic workbench) and compared with our desired output. The simulation output is shown in Fig.5.

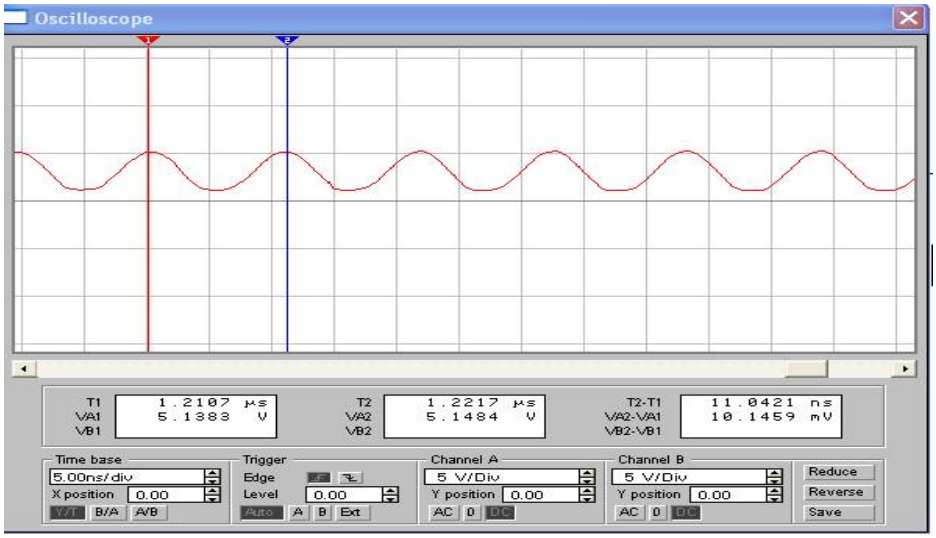

Fig.5: Simulation output of FM unit

The result of simulation is,

$$f = \frac{1}{T_2 - T_1} = \frac{1}{11.0421} Hz = 90.56 MHz \text{.....(1)}$$

Eq. (1) shows a little deviation from the desired output which is negligible in practice and the effect is not observed when the signal is received in the standard commercial receiver.

3 Conclusion

This work is done with a motivation to design and develop a prototype reliable system which could be commercially produced in local electronic industries at a very low cost. The system is simulated and tested which is found accurate and user friendly. Salient feature of this work is that it is computer controlled and anybody can operate it and install as a standalone system without much financial involvement. This system could be extended for far remote control using internet or GSM network by minor modification in present software or by introducing new application software.

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