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A Study of Communication between the Two PCs Using Pulse Code Modulation and Demodulation Technique

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Abstract-- Pulse Code Modulation (PCM) is an extension of Pulse amplitude Modulation (PAM) where in each analogue sample value is quantized into a discrete value for representation as a digital code word.The methods of serial data transmission imply that data are transmitted the following way: data are transmitted from transmitter to receiver bitwise simultaneously using only one line. We propose a technique which uses two channels provided on ST2103 & ST2104. It utilizes these two channels to communicate between two computers, thus forming a full duplex link

Keyword-- *PCM, PAM, Communication, Quantization, duplex.*

I. INTRODUCTION

Serial communication is the process of sending data one bit at a time, sequentially, over a communication channel or computer bus.Serial communication is used for all longhaul communication and most computer networks, where the cost of cable and synchronization difficulties make parallel communication impractical. Serial computer buses are becoming more common even at shorter distances, as improved signal integrity and transmission speeds in newer serial technologies have begun to outweigh the parallel bus's advantage of simplicity (no need for serialized and deserializer, or SerDes) and to outstrip its disadvantages (clock skew, interconnect density). The migration from PC to PC is an example [1]. Many serial communication systems were originally designed to transfer data over relatively large distances through some sort of data cable. The term "serial" most often refers to the RS232 port on the back of the original PC, often called "the" serial port, and "the" serial cable designed to plug into it, and the many devices designed to be compatible with it. Practically all long-distance communication transmits data one bit at a time, rather than in parallel, because it reduces the cost of the cable. The cables that carry this data (other than "the" serial cable) and the computer ports they plug into are usually referred to with a more specific name, to reduce confusion [1].

II. PULSE CODE MODULATION

Pulse-code modulation (PCM) is a method used to digitally represent sampled analog signals. It is the standard form of digital audio in computers, Compact Discs, digital telephony and other digital audio applications. In a PCM stream, the amplitude of the analog signal is sampled regularly at uniform intervals, and each sample is quantized to the nearest value within a range of digital steps.A PCM stream has two basic properties that determine the stream's fidelity to the original analog signal: the sampling rate, which is the number of times per second that samples are taken; and the bit depth, which determines the number of possible digital values that can be used to represent each sample [3].

A. Transmitter Block

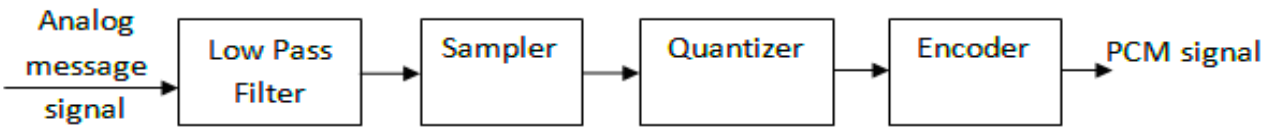

Figure 1: Transmitter

a. Sampler

An analog signal is first converted by a discrete-time sampling in-PAM signal. The still ongoing in the amplitude of the signal charges a capacitor controlled sampling. Both processes work with the same carrier and carried out in a function block of sample-andhold stage. The output signal is a time discrete and amplitude sections in the linearized PAM signal. The amplitudes of the stages are not discrete values, as it changes in proportion to the amplitude of the input signal [3].

b. Quantization

The maximum amplitude of the sample and hold analog signal is adapted to the conversion characteristics of a digital converter, A / D converter. The work area is assumed to lie between ± 5 V. One bit is necessary for the change of sign at the zero crossing. Dividing the amplitude range of the defined voltage in stages is called quantization [4].

c. Encoding

Encoding is the process of representing the sampled values as a binary number in the range *0* to *n*. The value of *n* is chosen as a power of 2, depending on the accuracy required. Increasing *n* reduces the step size between adjacent quantization levels and hence reduces the quantization noise. The down side of this is that the amount of digital data required representing the analogue signal increases [4].

B. Transmission Path

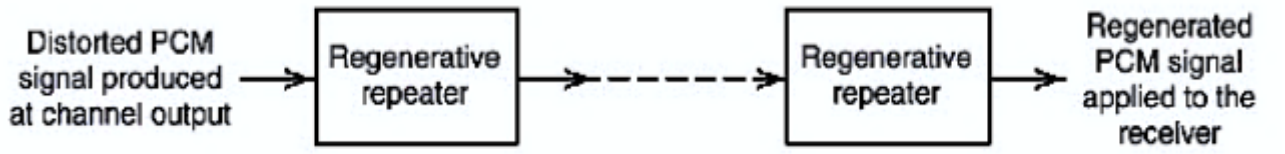

Figure 2: Transmission Path

a. Regenerative repeater

A regenerative repeater for alternate polarity PCM signals is disclosed that does not require an equalizer or amplifier. The PCM signals are directly detected by determining whether the slope of the pulse is greater or less than a reference value and if its polarity is opposite to that of the preceding pulse. The detected signals are reshaped by a monostable multivibrator and are retimed by a phase locked loop. The repeater is completely digital except for the slope comparator [4].

C. Receiver Block

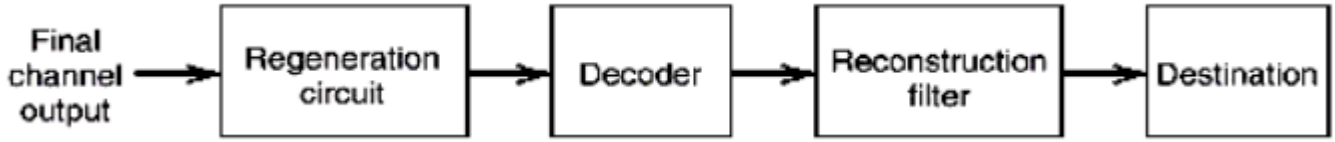

Figure 3: Receiver block

a. Decoder

The first operation in the is t regenerate (i.e., reshape and clean up) the received pulse. These clean pulse are grouped together into code-words and decoded.(i.e., mapped back) into a quantized PAM signal. The decoding process involves generating a pulse the amplitude of which is linear sum of all the pulses in the code word, with each pulse weighted by its place value [4].

b. Reconstruction filter

The final operation in the receiver is to recover the analog signal. This is done by passing the decoder output through a low pass reconstruction filter whose cutoff frequency is equal to the message bandwidth [4].Assuming that the transmission path is error free, the recovered signal includes no noise with the exception of the initial distortion introduced by the quantization process.

c. RS-232

In theory when organizing serial communication to transmit the signal from one device to another one should use only two wires - signal and ground. But practical work shows that this way of data transmission is not always usable, especially when data transmission is lengthy. It is connected with the fact that when receiving, the receiver may miss some bits and so they may be lost. This would cause changes in the result of the whole transmission. Even if one bit is lost, this may cause the following: when the whole data batch is received the bits coming after the lost bit may be shifted and erroneous data may be obtained when transforming into parallel code. In order to achieve reliable serial communication it should overcome all possible errors when receiving data. One of the possible solutions may be application of RS-232-C standard which describes the methods of synchronous and asynchronous data transmission in serial data format [2]. RS-232C, EIA RS-232, or simply RS-232, refers to the same standard defined by the Electronic Industries Association in 1969 for serial communication.

d. DTE and DCE

DTE stands for Data Terminal Equipment. A computer is a DTE. DCE stands for Data Communication Equipment. A modem is a DCE.DTE normally comes with a Male Connector, while DCE comes with a Female Connector.

e. RS-232 Pin outs (DB-9)

A male DB-9 connector viewed from the front. Reverse or back view of male connector for Female Connector.

Table 1: Pin assignment of DTE and DCE

DTE Pin Assignment (DB-9)			DCE Pin Assignment (DB-9)		
1	DCD	Data Carrier Detect	1	DCD	Data Carrier Detect
2	RxD	Receive Data	2	TxD	Transmit Data
3	TxD	Transmit Data	3	RxD	Receive Data
4	DTR	Data Terminal Ready	4	DSR	Data Set Ready
5	GND	Ground (Signal)	5	GND	Ground (Signal)
6	DSR	Data Set Ready	6	DTR	Data Terminal Ready
7	RTS	Request to Send	7	CTS	Clear to Send
8	CTS	Clear to Send	8	RTS	Request to Send
9	RI	Ring Indicator	9	RI	Ring Indicator

III. PROCEDURE

1. Keep PCs on either side of the ST2103 & ST2104.
2. Connect the RS232 cable to the serial port of the computer and the other end to ST2103 & ST2104 as shown in figure.
3. Make the interconnections between ST2103 & ST2104 as shown in the figure
4. Install the Software on both the PCs.
5. After establishing a connection, select the com port in the "COM Port" window, and select Baud rate (same on both PC's).

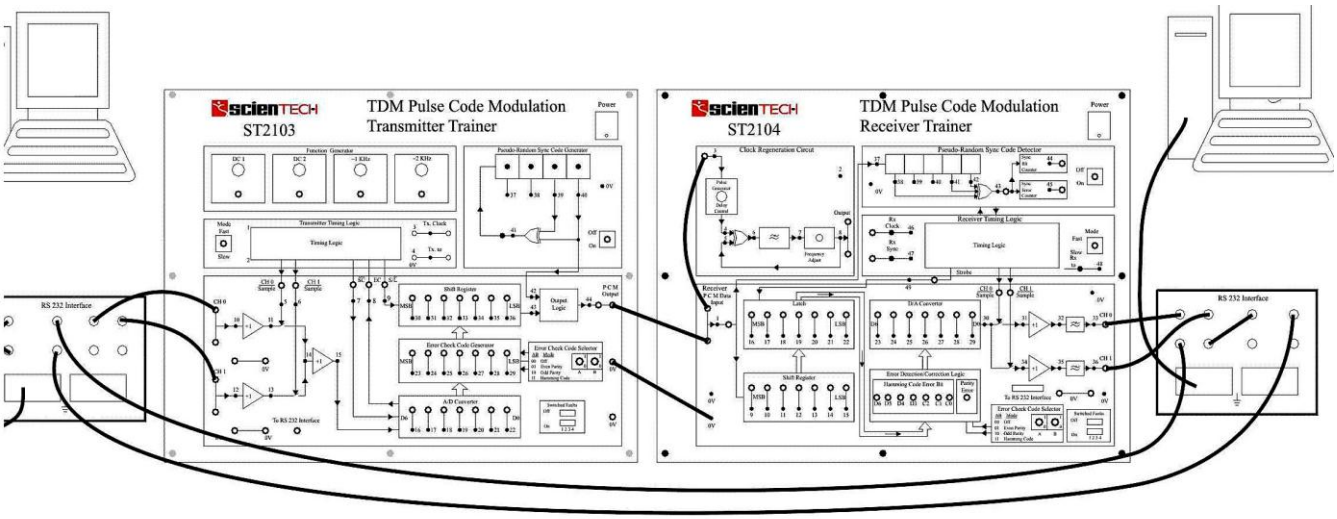

Figure 4: Pc to Pc communication diagram

6. Follow this procedure for both the computers.
7. Switch 'On' the trainers.
8. Now type a message in the message window of PC1 and click send, you will see the message in receiver window of PC2 and in transmit window of PC1.
9. If you send a message from PC2 you will receive the message in the receiver window of PC1 and in transmitter window of PC2.
10. If you disconnect any of the transmitting or receiving wire, you will see that the data transmission has failed.
11. On reducing the baud rate of both PCs and you will observe that the transmit rate is lower.

CONCLUSION

This paper has shown that pc to pc communication can be done using PCM through RS 232 .This perhaps is a natural consequence of this technique having evolved alongside two analog methods,i.e., pulse width modulation and pulse position modulation, in which the information to be encoded is in fact represented by discrete signal pulses of varying width or position, respectively. In this respect, PCM bears little resemblance to these other forms of signal encoding, except that all can be used in time division multiplexing, and the numbers of the PCM codes are represented as electrical pulses. The device can performs the coding and decoding function in a telephone, or other, circuit is called a codec.

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