DDS PROJECT REPORT

ON

Encrypted Data Transmission Using Morse Code

UNDER THE GUIDANCE OF:

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Abstract

This project is implemented with the idea of sending information from one place to another by encoding it in Morse Code. We have used BCD numbers from 0-9 and encoded it to Morse code. This information is sent through the transmission lines and decoded to display the information in both Morse code and decimal numbers using seven-segment display.

Introduction

What is Morse Code?

Morse code is a sequence of short and long signals called dots(.) and dashes (_). It is used for transmitting text information as a series of on-off tones, lights, or clicks that can be directly understood by a skilled listener or observer without special equipment. It was used to send telegraphs and telegrams in the 20^{th} century.

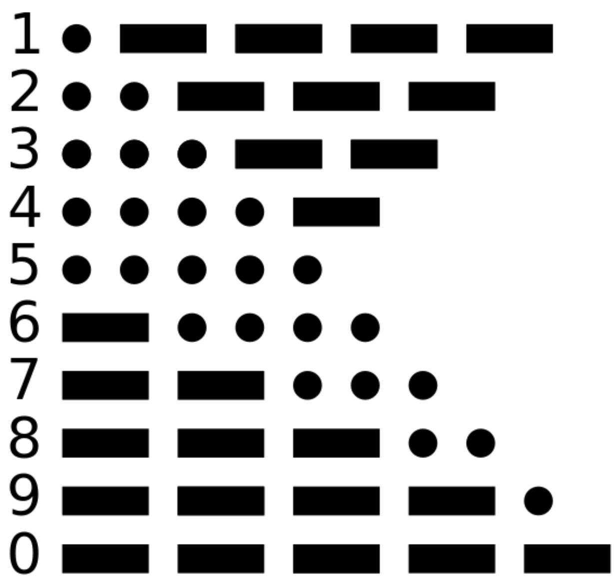
The are several advantages to Morse code or CW even in these days of advanced technology, digital transmissions and the like:

Simplicity: Its simplicity gives it some advantages. The first has already been mentioned and is its simplicity. The overall equipment required for transmitting and receiving Morse code is relatively straightforward, and this makes it ideal for ham radio constructors. Simple ham radio transmitters consisting of just a few transistors can be built and used to make contacts with ham radio stations all around the globe.

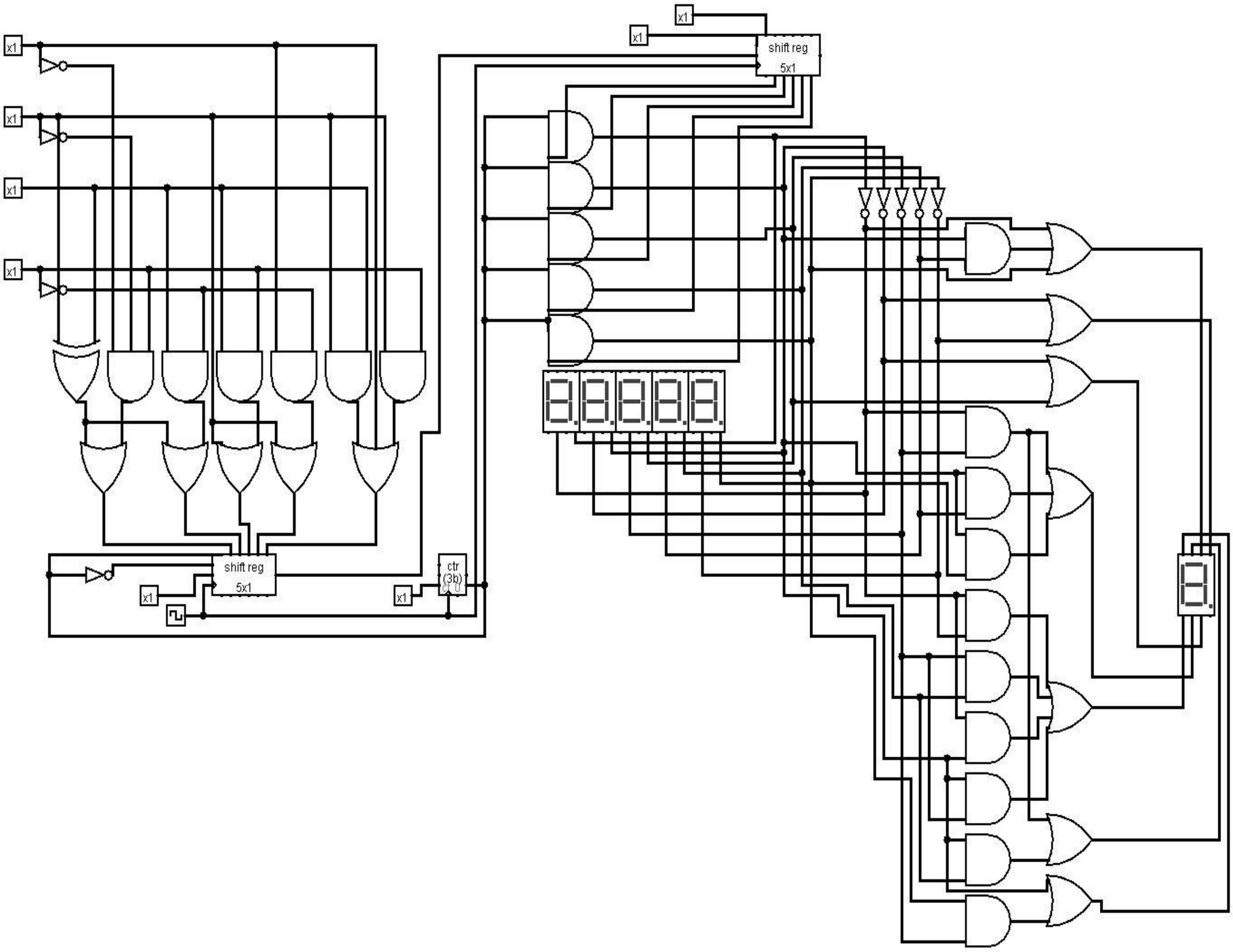
Bandwidth: The rate at which signaling is performed is relatively low, and this means that it occupies only a small bandwidth. This gives two advantages. The first is that a large number of stations can occupy a small section of the band, and secondly, narrow filters can be used to reduce the level of background noise and interference. Coupled with this the human brain can read Morse signals when they are lower than the surrounding noise level. As a result, it is possible to copy a Morse signal at a lower strength than any other form of transmission.

International appeal: They use a large number of abbreviations, and the formalized formats for ham radio contacts means that people from around the globe can use Morse or CW even with a poor command of languages like English that are widespread. Using the standard abbreviations basic contacts can be conducted with limited knowledge of the language of the other person. This may not be possible using other modes of transmission.

International convention for Morse code for digits from 0-9 is as shown below:

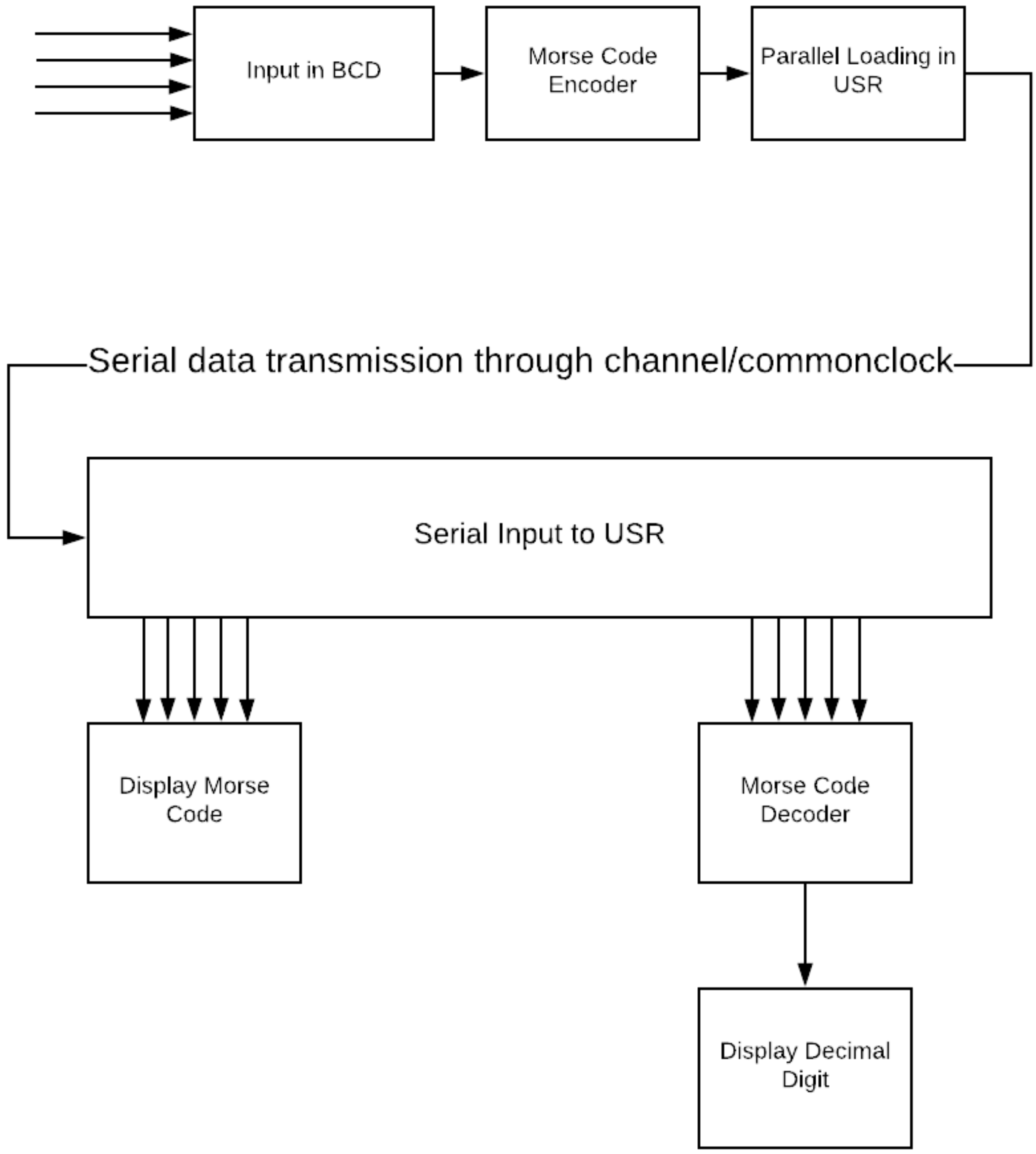


Circuit:



Working principle:

Block diagram of the complete circuit is as shown:



As from the block diagram it is clear that first, we encode B.C.D. data to be transmitted in Morse code according to our chosen convention that is 'dot' as 1 and 'dash' as 0. Then these bits are loaded in the USR in parallel loading mode. The counter is used to count the data bits which is five here then resets the shift register, the same clock is fed to receiver side USR.

At each CLK pulse, each bit from transmitter side USR is transferred to receiver side USR.

Morse code is displayed directly using the output of the USR on the receiver side, but for Decimal display, data bits are decoded and expressions solved for displaying on seven-segment (common cathode).

To prevent unnecessary data on the seven segment displays we ANDed all the output of the USR on receiver side with the reset of the counter, as when all bits are transferred then only the displays become active. The counter is a mod 5 counter. Once all the data bits are transferred, it gives a high pulse which enables the decoder and also takes the parallel input for the next number.

Circuit implementation:-

K-MAPS:

K-Maps

→ Encoder

Assumption — input bits Q_a, Q_b, Q_c, Q_d (MSB … LSB)

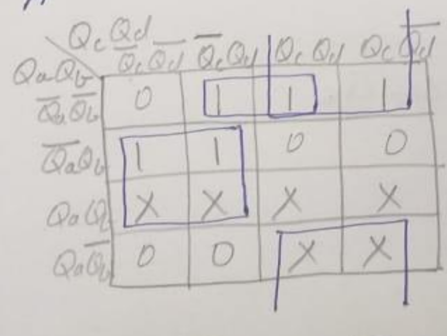
output bits A, B, C, D, E

morse code convention $1 \rightarrow \cdot$ $\quad 0 \rightarrow -$

Truth Table

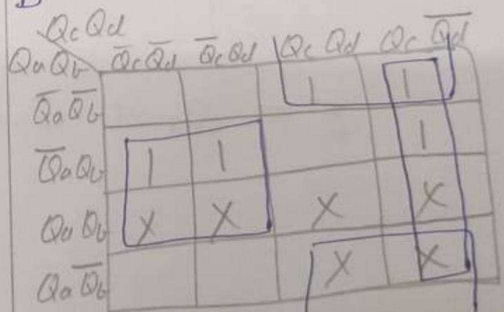
Q_a	Q_b	Q_c	Q_d	A	B	C	D	E
0	0	0	0	0	0	0	0	0
0	0	0	1	1	0	0	0	0
0	0	1	0	1	1	0	0	0
0	0	1	1	1	1	1	0	0
0	1	0	0	1	1	1	1	0
0	1	0	1	1	1	1	1	1
0	1	1	0	0	1	1	1	1
0	1	1	1	0	0	1	1	1
1	0	0	0	0	0	0	1	1
1	0	0	1	0	0	0	0	1

A

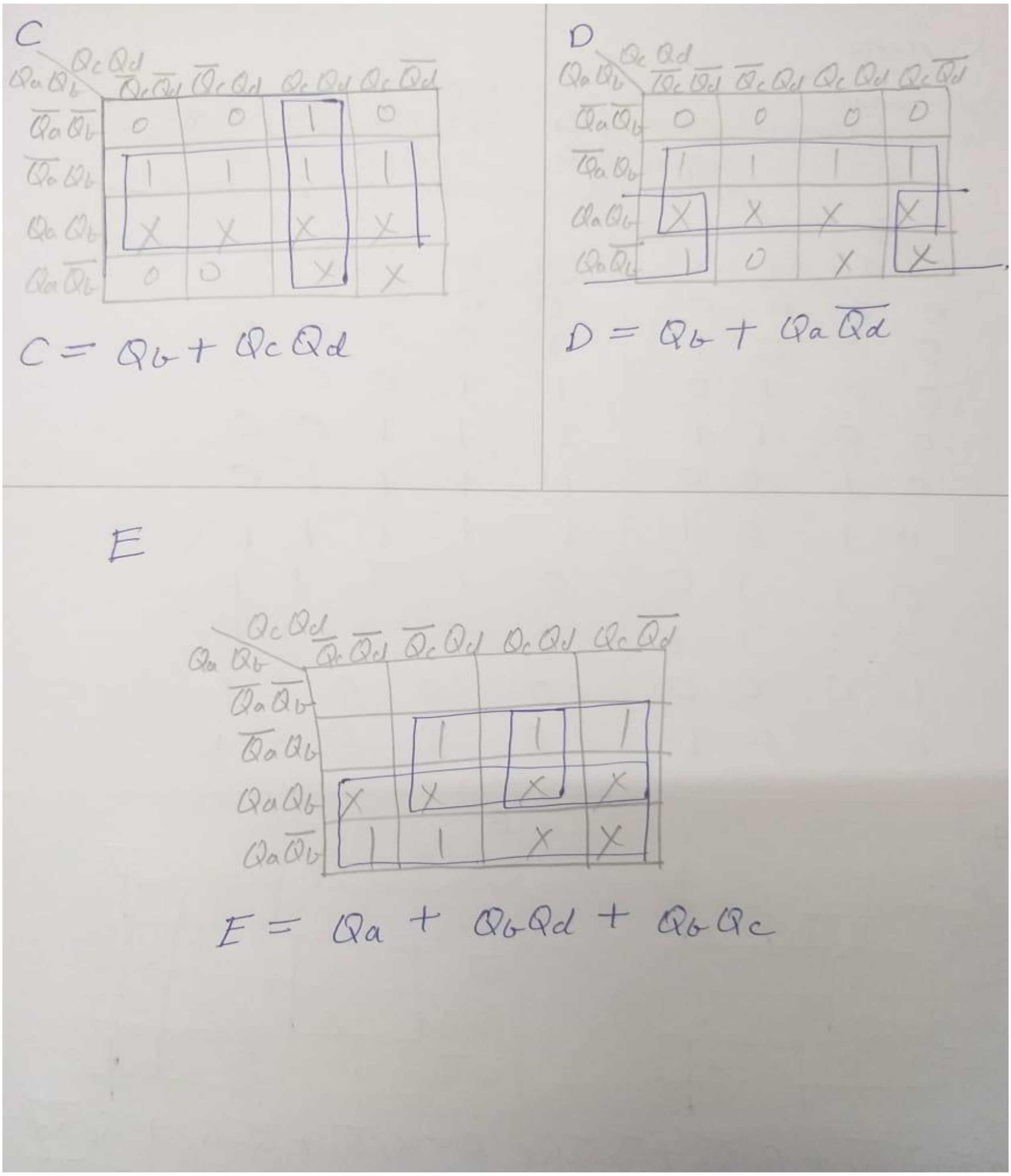


$$A = Q_b\overline{Q_c} + Q_c\overline{Q_b} + \overline{Q_a}\,\overline{Q_b}Q_d$$
$$= (Q_b \text{ XOR } Q_c) + \overline{Q_a}\,\overline{Q_b}Q_d$$

B



$$B = Q_b\overline{Q_c} + \overline{Q_b}Q_c + Q_c\overline{Q_d}$$
$$= (Q_b \text{ XOR } Q_c) + Q_c\overline{Q_d}$$


C
$C = Q_b + Q_c Q_d$
D
$D = Q_b + Q_a \overline{Q_d}$
E
$E = Q_a + Q_b Q_d + Q_b Q_c$

Equations:

The circuit is implemented in a minimum cost design.

Encoder:

Assume the inputs bits as Qa, Qb, Qc and Qd and the input for the USR as A, B, C, D and E. The equation for the USR inputs are:

A = (Qb XOR Qc) +Qa’.Qb’.Qd

B = (Qb XOR Qc) + Qc.Qd’

C = Qb + Qc.Qd

D = Qb + Qa.Qd’

E = Qa + Qb.Qc + Qb.Qd

Decoder:

For Seven-Segment Display:

a = A’ + E + BD’

b = B’ + E’

c = B’ + C

d = A’C’ + BD’ + B

e = A’E’ + C’D + A’B + BC’

f = A’C’ + BD

g = E + B

Conclusion

Morse code is still widely recognized, even though it is not as widely used as it once was. Morse code is prevalent in aviation and aeronautical fields, however, what is more, striking is that it can be used for communication by people with disabilities. There have been cases where individuals have been able to use their eyelids to communicate in Morse code by using a series of long and quick blinks to represent the dots and dashes in Morse code. Our circuit demonstrates the simplicity of a Morse code generator and gives us an idea of how we can use this simple but effective way of communication for not only data encryption purposes but also for medicinal purposes.

References:

- Morris Mano - Registers and Counters
- Wikipedia - https://en.wikipedia.org/wiki/Morse_code
- https://owlcation.com/humanities/morse_code