*International Journal of Engineering & Technology*, 7 (4.10) (2018) 1-3

**International Journal of Engineering & Technology**

*Website: www.sciencepubco.com/index.php/IJET*

***Research paper***



# Multilevel Encryption of Messages for Secured Communication

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**Abstract**

The security of information passed through the communication channel has become a major concern. Encoding of the messages before transmitting through the channel is most vital. We propose a three level encryption (encoding) using musical notes in traditional Indian and Western system as well as the American Standard Code for Information Interchange (ASCII). A unique method for the decryption is also mentioned in the paper.

***Keywords***: *American Standard Code for Information Interchange (ASCII); Decryption; Encryption; Traditional Indian musical notes; Western musical notes*

## 1. Introduction

The tremendous development of technology in communication has made the security of messages inevitable. Cryptography has been playing an important role in the transfer of secured messages through the communication channels. Cryptography is a unique technique of storing and transmitting messages in a particular form so that only the real person for whom it is introduced can interpret and process it. This is of great use in the e-world especially e-commerce. Here the key for first level and second level encryption is traditional Indian Musical notes and Western musical notes respectively.[3][5] The American Standard Code for Information Interchange (ASCII) is used for the next level encryption.[6]In ASCII code, for each symbol in the character set such as letters, digits, and punctuations marks, special characters and control characters an integer value is associated.

## 2. Preliminary Notes

### 2.1. Western Musical Notes

The Basic Western musical notes consists of C, D, E, F, G, A and B.

**Table 1:** Western Musical Notation

| Indian Musical Notes | Western Musical Notes |
|---|---|
| SA | C |
| RE | D |
| GA | E |
| MA | F |
| PA | G |
| DA | A |
| NI | B |

### 2.2. Indian Musical Notes

The basic Indian musical note consists of Sa, Re, Ga, Ma, Pa, Da, and Ni.

**Table 2:** Indian Musical Notation

| Alphabet | Indian Musical Conversion |
|---|---|
| A | SA |
| B | RE |
| C | GA |
| D | MA |
| E | PA |
| F | DA |
| G | NI |
| H | SARE |
| I | REMA |
| J | SAGA |
| K | SAMA |
| L | PANI |
| M | DASA |
| N | SAPA |
| O | NIPA |
| P | SADA |
| Q | SANI |
| R | RESA |
| S | GASA |
| T | REGA |
| U | REPA |
| V | GADA |
| W | REDA |
| X | RENI |
| Y | GARE |
| Z | GAMA |

### 2.3. The American Standard Code for Information Interchange (ASCII) Character Set

Standardized numeric codes are used in computers to represent Character data. The worldwide acknowledged code is called the American Standard Code for Information Interchange (ASCII).The ASCII code associate an integer value for each symbol in the character set, such as letters, digits, punctuation marks, special characters and control character. The ASCII character and their decimal code values are shown in the table given.

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**Table 3:** ASCII Table

| Alphabet/Character | Decimal |
|---|---|
| A | 65 |
| B | 66 |
| C | 67 |
| D | 68 |
| E | 69 |
| F | 70 |
| G | 71 |
| H | 72 |
| I | 73 |
| J | 74 |
| K | 75 |
| L | 76 |
| M | 77 |
| N | 78 |
| O | 79 |
| P | 80 |
| Q | 81 |
| R | 82 |
| S | 83 |
| T | 84 |
| U | 85 |
| V | 86 |
| W | 87 |
| X | 88 |
| Y | 89 |
| Z | 90 |

**Table 4:** Key for encoding of spaces

| | |
|---|---|
| Space between two different words | 0 |
| Distinguishing two letters of encoded message | 1 |

# 3. Proposed Encryption Scheme

Our proposed system of three level encryption has been developed using Indian musical notes, western musical notes and American Standard Code for Information Interchange (ASCII) as keys for encryption[2][5]. In the projected method we apply a three stage of encryption as follows. First we encrypt our message into Indian musical notes , which is achieved by converting each and every letter of the message into Indian musical notes, during this encrypting we use 0 for the space between two different words of the plain text and 1 for space between two letters of same word in the message[6]. We get a single block of encrypted message with Indian musical notes as well as the digits 0 and 1, in between representing the letters and words in the message. The second level encryption is done using the key- Western musical notes[1]. While encrypting the 0 and 1 of the first level encrypted message is unaltered. The third level encryption is achieved with the Key- American Standard Code for Information Interchange (ASCII). Here also the digits 0 and 1 remain unaltered.

Table 2 is the key for first level encryption using Indian musical notes. Table 1 is the key for second level encryption using Western musical notes and Table 3 is the key for third level encryption using ASCII codes. The most vital part which ensures the security is the devising of the Table 1 and Table 2.The 26 English alphabets can be permuted among themselves in 26! ways likewise the 7 musical notes can be permuted in 7! ways. For any of these permutations the western musical notes can be assigned which will be possible in 7! ways. The 7 basic Indian musical notes SA RE GA MA PA DA NI can be used to encode the alphabets A B C D E F G and the remaining alphabets are encoded with a choice of combination of Indian musical notes which is as per the choice of the encoder.

As a representative if we take the letter X of English alphabet using the table 2 it can be encoded as RENI which is only one among the possible permutations of the combination of musical notes. This ensures the security for the encoder as it is unique as per his choice. Accordingly the Table 1 can be created in any one of the $(26\ !)^2$ ways. The key for the encryption in the first level is as per Table 1 and the subsequent level as per table 2 and 3 respectively [6].

# 4. Algorithm

### 4.1. Encryption Algorithm

Let M be the message to be encrypted.

- Step 1: Use Table 1 to convert M into Indian music note ($M_1$) (We use 1 for space between the letters of the same word and 0 to distinguish different letters of same word.)
- Step 2: Convert ($M_1$) into western music note ($M_2$) using the values from Table 2. (While encrypting the 0 and 1 of the first level encrypted message is unaltered.)
- Step 3:Convert ($M_2$) into numbers ($M_3$) using Table 3. (Digits 0 and 1 remain unaltered.)
- Step 4: ($M_3$) is send to the receiver.

### 4.2. Decryption Algorithm

- Step 1: Use Table 3 to obtain ($M_2$) from ($M_3$). Make pair of numbers (We have used 0 and 1 to represent the space between words and letters. Also for the decryption 0 and 1 are not encrypted, an alphabet is represented by a two digit number which starts from 65. No alphabet is encrypted using 00, 01,... and its only 1,2,3... ). Corresponding to each two digit numbers decode the number to alphabets from the ASCII table to get the Western music notes.
- Step 2: From ($M_2$) obtain ($M_1$) using table 2.
- Step 3:From ($M_1$) generate the plain text using table 1.

# 5. Illustration

### 5.1. Encoding Decoding

Suppose the message (M) to be encoded is I LOVE INDIA.

- Step 1: The message (M) is then encrypted into Indian music notes ($M_1$) using Table 1 and space between words and letters is represented by 0 and 1respectively.
  Word 1: I = REMA0
  Word 2: LOVE = PANI1NIPA1GADA1PA0
  Word 3: INDIA = REMA1SAPA1MA1REMA1SA
  So that ($M_1$) becomes;
  ($M_1$)=REMA0PANI1NIPA1GADA1PA0REMA1SAPA1MA1 REMA1SA
- Step 2: ($M_1$) is again converted to Western music notes ($M_2$) using Table 2.
  REMA0 = DF0
  PANI1NIPA1GADA1PA0 = GB1BG1EA1G0
  REMA1SAPA1MA1REMA1SA = DF1CG1F1DF1C
  (Note that here 0 and 1 of the first level encrypted message is unaltered.)
  So that ($M_2$) becomes DF0GB1BG1EA1G0DF1CG1F1DF1C
- Step 3: ($M_2$) is now converted to numbers ($M_3$) using Table 3. (Digits 0 and 1 remain unaltered.)
  ($M_3$)= 68700716616671169651710687016771170168701670
  which is sent to the receiver.

### 5.2. Decoding

Let the received message is:
($M_3$)=68701677117016870167068701706706567170680701667116871167711687016867170 68

- Step 1: Make them into pair keeping in mind the conditions which we have from the ASCII table. And remember that 0 and 1 represent the space between words and letters respectively.
  68 70 1 67 71 1 70 1 68 70 1 67 0 68 70 1 70 67 0 65 67 1 70 68 0 70 1 66 71 1 68 71 1 67 71 1 68 70 1 68 67 1 70 68

Decode the numbers from the Table 3 get Western music notes;
$M_2$:DF1CG1F1DF1C0DF1FC0AC1FD0F1BG1DG1CG1DF1DC1FD
Therefore, *Word 1:* DF1CG1F1DF1C
*Word 2:* DF1FC
*Word 3:* AC1FD
*Word 4:* F1BG1DG1CG1DF1DC1FD.

- Step 2: Now using Table 2 decode into Indian music notes;
*Word 1:* REMA1SAPA1MA1REMA1SA0
*Word 2:* REMA1GASA0
*Word 3:* DASA1GARE0
*Word 4:*GA1NIPA1REPA1SAPA1REGA1RESA1GARE
Therefore:
($M_1$)REMA1SAPA1MA1REMA1SA0REMA1GASA0DASA1GARE0GA1NIPA1REPA1SAPA1REGA1RESA1GARE
- Step 3: Now using Table 1 decode ($M_1$) to get the message M and the words are decrypted as
*Word 1:* INDIA
*Word 2:* IS
*Word 3:* MY
*Word 4:* COUNTRY
So the decoded message is INDIA IS MY COUNTRY.

## 6. Conclusion

We have three stages of encryption; using Indian musical notes, Western musical notes and the ASCII table. It is difficult for a third person to hack the messages without knowing the correct conversion of alphabets. Also the alphabets can be assigned any of the $(26!)^2$ ways using the Indian musical notes and the 7 western musical notes can be arranged in $(7!)^2$ ways which can be generated as the desire of the encoder and decoder. Also one cannot decode the message without knowing the correct method of pairing the numbers from the ASCII table. This system of encryption increases the security level of the message which is being sent to the receiver without getting tampered.

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