

**RESEARCH PAPER**

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**CRYPTOGRAPHY USING MUSIC NOTES**

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**Abstract:** Any musical note consists of seven basic keys. Our traditional Indian music is made of the seven keys Sa, Re, Ga, Ma, Pa, Dha, Ni. The western music notes are based on the seven keys C, D, E, F, G, A, B. Using these as the basic notes music is developed. Use of music notes in encrypting any message is not in wide use. In this paper we propose a method of encryption of any text message using the Indian and western music notes.

**Keywords:** sargam, encryption, decryption, music notes, keyboard.

**INTRODUCTION**

With the rapid development of network and multimedia technologies, the digital information has been applied to many areas in real-world applications. Communication has become a very important aspect in today's life. So, security plays an important role in transferring the data. One such way to secure information is cryptography.

In cryptography we hide the information from unauthorized users by employing various techniques, encryption is one such technique where we transform the data into a form understandable only by the authorized users. We need to hide the data for privacy purpose and for ensuring data received at the authenticated user end is not modified. We have several encryption and decryption algorithms for encrypting the data at sender end and decrypting the same at receiver side ensuring secure data transfer [ 3 ].

**PRELIMINARY NOTE**

In this section we provide a brief introduction to Indian music notation and keyboard notation.

**Keyboard Notation:**

Musical notation is the representation of sound with symbols. Any music can be represented using these symbols. The basic notes in music are C, D, E, F, G, A and B. A pause in music is represented by -. The following diagram represents the musical notation from C to B [ 1 ].



Figure: 1

**Indian Musical Notation:**

The seven music notes in Indian music note are called Sudda Swar Sa Re Ga Ma Pa Da Ni.

The comparison of Indian music note to the key board is shown below [ 2 ].

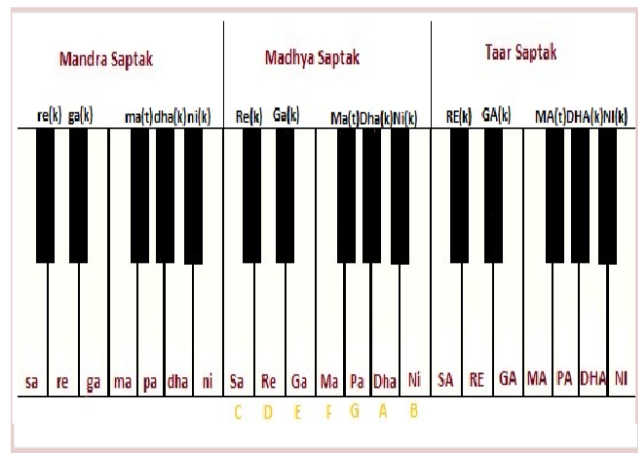


Figure: 2

R	MARE	9	NINI
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**PROPOSED ENCRYPTION SCHEME**

Here we propose a method of encryption of any message using traditional Indian music and keyboard representation as a tool of encryption.

In the proposed method we apply two levels of encryption. First we convert a normal text into traditional Indian music note using table 1. We then convert the text into western music notes of a piano or a key board. While converting we use 1 for space between same word and 0 for space between two different words.

Table 1 provides the conversion of alphabets and numbers into Indian musical notes. Table 2 provides the conversion into western music notes.

Designing table 1 and 2 is the choice of the person sending the message. The alphabets from A – Z and numbers from 0 – 9 can be arranged in 36! Ways. For each choice of these 36! ways we can arrange the music notes in 36! ways. Similarly table 2 can be designed in 7! Ways and for each choice of these 7! Ways the music notes can be arranged in 7! Ways. These two tables will be the key for encryption and decryption.

Table 1: Conversion to Indian Musical Notes

Alphabet / Number	Music Conversion	Alphabet / Number	Music Conversion
A	SA	S	GASA
B	RE	T	SAMA
C	GA	U	REPA
D	MA	V	GADHA
E	PA	W	MANI
F	DHA	X	PASA
G	NI	Y	SAPA
H	SAGA	Z	NIMA
I	REMA	0	DHAGA
J	GAPA	1	PARE
K	MADHA	2	MASA
L	PANI	3	SASA
M	DHASA	4	RERE
N	SADHA	5	GAGA
O	NIPA	6	MAMA
P	DHAMA	7	PAPA
Q	PAGA	8	DHADHA

In table 1 we see that the first seven alphabets are assigned the basic music notes Sa, Re, Ga, Ma, Pa, Dha, Ni. The remaining alphabets from H – Z and the numbers 0 – 9 are assigned a conversion which is a combination of the seven music notes. This can be designed as per the choice of the encoder and decoder.

For example the number 9 is assigned a conversion NINI in table 1. But instead we could assign any other combination like MAPA, NIDHA (Note hat these are not used in the table). So designing the table is purely the choice of the encoder and decoder. This increases the possible ways in which the table can be designed apart from the  $(36!)^2$  ways shown in the table 1.

Table 1 is the main key for encryption of any message containing a string of alphabets and numbers

Table: 2 Conversions to Western Musical Notes

Indian Music Note	Keyboard Notation
SA	C
RE	D
GA	E
MA	F
PA	G
DHA	A
NI	B

Space between two letters of same word	1
Space between two different words	0

**Algorithm:**

In this section we provide the encryption decryption algorithm and an illustration explaining the algorithm.

**Encryption Algorithm:**

Let S be the text to be encrypted

**Step 1** Convert S into Indian music note S1 using table 1.

**Step 2** Convert S2 into keyboard music note S2 using table 2.

**Step 3** Send S2 to the receiver.

**Decryption Algorithm:**

**Step 1** From S2 obtain S1 using table 2.

**Step 2** From S1 generate S using table 1.

**ILLUSTRATION**

Suppose the message to be encoded is I LOVE MUSIC

Convert this into Indian music notes using table 1 we get S1 as

**Word 1** REMA

**Word 2** PANI NIPA GADHA PA

**Word 3** DHASA REPA GASA REMA GA

So that string S1 is

S1 REMA PANI NIPA GADHA PA DHASA REPA GASA REMA GA (seperated by space).

S1 is again converted into keyboard notation S2 using table 2 as

S2 DF0GB1BG1EA1G0AC1DG1EC1DF1E

Note that here 0 represents the space between words and 1 space between letters in the same word to enable encryption.

Send DF0GB1BG1EA1G0AC1DG1EC1DF1E to the receiver.

Suppose the received message is

AC1DG1EC1DF1E0FD1DG1DF1CA1G1F0AC1G

We know that 0 represents the space between words. So we understand that there are three words in the message received. They are

**Word 1** AC1DG1EC1DF1E

**Word 2** FD1DG1DF1CA1G1F

**Word 3** AC1G

In each word 1 represents the space between letters. Using table 2 we convert the words as

**Word 1** DHASA REPA GASA REMA GA

**Word 2** MARE REPA REMA SADHA PA MA

**Word 3** DHASA PA

Now using table 1 the words are converted as

**Word 1** MUSIC

**Word 2** RUINED

**Word 3** ME

So the decoded message is **MUSIC RUINED ME.**

## CONCLUSION

We have used two levels of encryption one using traditional Indian music note and second using our usual keyboard notes. It is difficult for any hacker to break the code unless the conversion order into alphabets is known.

Also the 36 alpha numeric characters can be arranged in a minimum of  $(36!)^2$  Ways and the 7 music notes in table can be arranged in  $(7!)^2$  ways so that we can generate a table of our choice. This increases the safety of the encrypted message and this arrangement acts as a key for encryption and decryption. So the proposed encryption scheme is safe for encoding any message.

## REFERENCES

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## SHORT BIO DATA FOR THE AUTHOR

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