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Research Article

DATA ENCRYPTION AND DECRYPTION USING GUITAR STRINGS

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Abstract

A basic guitar is a musical string instrument with six strings. In standard tuning they have the notes E, A, D, G, B and E having different notes on each FRET. In this paper we have proposed an algorithm for encryption and decryption that uses the layout of these notes on each string.

Keywords: Guitar fret board, musical notes, FRET (Förster resonance energy transfer), Encryption and Decryption.

1. Introduction

The security of a system is essential nowadays. With the growth of the information technology power and with the emergence of new technologies, the number of threats a user is supposed to deal with is growing exponentially. Cryptography is where security engineering meets mathematics. It provides us the tools that underlie the most modern security protocols. It is probably the key enabling technology for protecting distributed systems, yet it is hard to do. Cryptography consists in processing plain information by applying a cipher and producing encoded output, meaningless to a third-party who does not know the key. In cryptography both encryption and decryption phase are determined by one or more keys[1]. Encryption becomes vital for a secure and safe environment for the computers and the Internet. In cryptography, encryption is the process of encoding messages (or information) in such a way that allows access only to the authorized parties hence keeping it safe from eavesdroppers or hackers. In an encryption scheme, the message or information (referred to as plaintext) is encrypted using an encryption algorithm, turning it into an unreadable cipher text. Decryption is the reverse process to Encryption [2]. In [4], the authors dealt encryption and decryption concepts using pair of dice. In this paper we propose the Cryptography algorithm that uses the layout of the musical notes on a basic guitar in standard tuning.

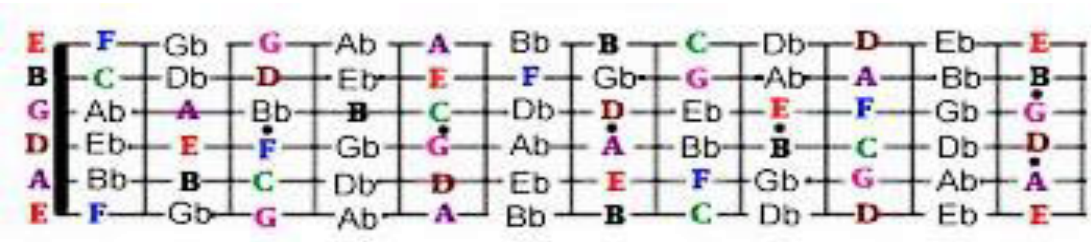
2. Preliminaries

In this section we are going to provide an introduction to the guitar fret board, musical notes. As the proposed encryption uses conversion of decimal number to binary number it requires user to know about conversion of decimal to binary and vice versa also.

2.1. Guitar Notations

A guitar has a fret board that consists of various frets. Above a fret board are the strings of the guitar that upon being pressed against a fret produces a musical note. Each fret on a guitar produces a different note on a particular string.

Guitar fret board Diagram



3. Proposed Scheme

Here we propose a method of encrypting and decrypting any message using the musical notes and guitar strings.

3.1 Encryption

In the algorithm first a string is selected randomly (0, 1, 2, 3, 4, 5) and then the corresponding note is derived whose position on the guitar string will be the required fret (1 to 12).

The alphabets are divided into groups using the formula.

Group = ((ASCII values of alphabet)-65)/7

Table 1 shows the division of alphabets into the group and the notes used to denote them.

Table 2 shows the ASCII encodings of English Alphabets.

Table-1: Division of Alphabets into groups.

Note **Group**	**A**	**B**	**C**	**D**	**E**	**F**	**G**
0	A	B	C	D	E	F	G
1	H	I	J	K	L	M	N

2	O	P	Q	R	S	T	U
3	V	W	X	Y	Z		

Table-2: ASCII Values of Alphabets

Letter	ASCII Code	Binary	Letter	ASCII Code	Binary
a	097	01100001	A	065	01000001
b	098	01100010	B	066	01000010
c	099	01100011	C	067	01000011
d	100	01100100	D	068	01000100
e	101	01100101	E	069	01000101
f	102	01100110	F	070	01000110
g	103	01100111	G	071	01000111
h	104	01101000	H	072	01001000
i	105	01101001	I	073	01001001
j	106	01101010	J	074	01001010
k	107	01101011	K	075	01001011
l	108	01101100	L	076	01001100
m	109	01101101	M	077	01001101
n	110	01101110	N	078	01001110
o	111	01101111	O	079	01001111
p	112	01110000	P	080	01010000
q	113	01110001	Q	081	01010001
r	114	01110010	R	082	01010010
s	115	01110011	S	083	01010011
t	116	01110100	T	084	01010100
u	117	01110101	U	085	01010101
v	118	01110110	V	086	01010110
w	119	01110111	W	087	01010111
x	120	01111000	X	088	01011000
y	121	01111001	Y	089	01011001
z	122	01111010	Z	090	01011010

After the group is selected, the corresponding note is selected according to the table-1. Then the fret number is observed on the random string at which the corresponding note is located. (Refer diagram).

The final output contains the following parts:

Group number + (Fret Number + Random String) + Fret Number

The group number consists of 4 bits. If all the bits are 1 (i.e. 1111) then the encoded character is a space. In case the first two bits are 01 then the encoded letter is a small case letter and if the first two bits are 00 then it is a capital letter.

For Example: To Encrypt a word "HeLLO".

1. First a guitar string will be selected at random. Let 0 be the selected string for 'H'.
2. Find the group. Group= (72-65)/7=1
3. From the table we can see that musical note corresponding to letter 'H' is 'A'.
4. Now on string 0 musical note 'A' can be found on 5^{th} fret. So H will be encoded as 1 5 5 in binary i.e. 0001 00001010101.
5. For letter 'e' let the random string selected be 3.
6. Now the group selected will be 0 and corresponding musical note will be 'E' so on the third string the 'E' note will be at fret number 2. So 'e' will be encoded as 0 5 2 converting to binary 0000 0000101 0010 but because of small case output will be 0100 0000101 0010.
7. Similarly, on encoding other letters taking random string for letters 'L','L','O' as 0, 5 and 3 respectively we can find the encryption of word as:

H	e	L	L	O
0001 0000101 0101	0100 0000101 0010	0001 0001100 1100	0001 0010001 1100	0010 0001010 0111

3.2 Decryption

While decrypting first the input is observed. Set of 15 bits are considered if first four bits are not 1111. If first four bits are 1111(blank space) consider the next 15 bits. Encrypted code consists of three sets divided into 4bits 7bits and 4bits.These set of numbers represent Group number with type, (Fret Number + Random String) and Fret Number respectively. The first two bits of first set are considered to check the case of letter (upper-00 or lower-01). The randomly generated string number is calculated by subtracting third set of number from second set of number. Musical Note is found according to the Guitar fret board diagram using the random string number and the fret position in that string. Then using the Note and group number the code is decrypted.

For Example: To decrypt:

000100001010101010000001010010000100011001100000100100011100001000010100111

1. To decrypt the above code, we consider the first 15 bits (first 4 are not 1111) and divide it into 4 bit-7bit-4bit.So for above code it will be: 0001 0000101 0101
2. Since first two bits are 00, the letter is capital.
3. The group number is calculated by using the next two bits 01 i.e. Group 1.
4. Fret Number is found using third set of numbers 0101 i.e. 5 and Random String is 5-5=0.
5. So in 0^{th} string on fret number 5 musical note is 'A'.
6. Then using the group table (table 1) the character can be found as 'H'. Hence the first character is decrypted as 'H'.
7. Similarly, we get 'H', 'e', 'L', 'L' and 'O' from the rest of the given code.

4. Conclusion

In this paper we have proposed a new safe encryption method to transfer a message to the receiver using the layout of a basic guitar as a key. Most of the people have no idea about the layout of the guitar which makes decryption difficult. For encryption of any alphabet 5 different codes are available, as a random string is chosen out of 5 different strings. This decreases its chances of being hacked to a great extent. So the proposed algorithm is very efficient and safe to use.

References:

1. M. Yamuna, K. Karthika," Chemical formula: Encryption using graph domination and molecular biology", International Journal of ChemTech Research, 5(6), Oct-Dec 2013.
2. M. Yamuna, Mukesh Kumar Dangi , Kishan Singh, "Encryption of a binary string using DNA sequence", The International Journal of Computer Science & Application,2(2),April 2013
3. Java the Complete Reference (by Tata McGraw Hill publication).
4. V.M. Chandrasekaran, A. Manimaran, Akhil Ranjan,"Cryptography using a Pair of Dice", International Journal of Pharm Tech Research, 7(1) (2014), 85-89.
5. http://sticksandstones.kstrom.com/appen.html
6. http://www.guitar-skill-builder.com/guitar-fretboard-notes.html

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