GLOBAL ACADEMIC RESEARCH INSTITUTE

COLOMBO, SRI LANKA

GARI International Journal of Multidisciplinary Research

Author: P. Rukshani, K. Sujatha, SSS Suthaharan

(Vavuniya Campus, Sri Lanka)

MUSIC THEORY AND ITS TRAITS IN ENHANCING INFORMATION SECURITY

[1]P Rukshani, [2]K Sujatha, [3]SSS Suthaharan

[1]*Faculty of Technological Studies,* [2,3]*Faculty of Applied Science,*

[1,2,3]*Vavuniya Campus, University of Jaffna, Sri Lanka*

[1]*rukupuvan@gmail.com*

ABSTRACT

The Data Communication plays a vital role in the Information and Communication Technology era. The new Technologies have changed the conventional way of information exchange with the advancement of information and communication technology. Music, fine art, or an art of ordering tones and sounds in succession and in combination that's concerned with the medium of sound and can be created using musical instruments with musical notes to produce splendor of harmony and expression of emotions. In this era, the demand for securing information is particularly needed and preferred. Music theory and its attributes have been used in securing information exchange in the form of cryptography from the early days. Presently, music is immeasurably utilized in securing information with the utilization of steganography. The craft of scrambling and covering messages utilizing music is named as Musical Steganography. Further melodic notes and images have been utilized as codes and keys. The covering up is actualized by planning a calculation for the encryption of a piece designed message into music utilizing its traits and the decoding in the other way around. In this paper, we propose a calculation which changes over the bit into melodic notes by utilizing some numerical properties. Further, the study two-level safety efforts utilizing the Musical Cryptography and with Musical Steganography strategies. In this way, the security of the message improves through the above proposed scheme.

Keywords: Steganography, Cryptography, data security, information hiding, Musical steganography

INTRODUCTION

During the most recent couple of decades, there is a gigantic advancement in Information and Communication Technology. The Data communication has been assuming a significant job in our everyday lives, with the accessibility of numerous innovations. The ICT contributes in many aspects of human life such as communications, education and online commercial activities. In this manner, security in the data in communication through the Internet has become a threat.

With the advancement in ICT, most of the information is kept electronically; consequently, the efficient security mechanism is required to assure confidentiality, integrity and authentication. Different mechanisms have been utilized for secure communication from the ages of Julius Caesar. The process of secure information exchange demands techniques that convert the message into an unintelligible form. For communication over the public network, information can be ensured by predominantly two procedures that are Cryptography and Steganography (Chandan Kumar, 2014) (M. Yamuna).

Cryptography converts the data by any other encryption algorithm using the key in the scrambled form; only those having access the key can decrypt the encrypted data. In steganography, the secret information is hidden inside some other file without degrading the quality of the file. Various steganography techniques use a cover file that also called a stego object to hide the message in it. Due to the enormous advancement of computing power, some techniques address the issues of Confidentiality, Integrity, and Authentication. In this paper, we present an algorithm with the combination of cryptography and steganography techniques associated with the music theory to enhance the security of the data transmission in a public network (M. Yamuna).

The melodic notes in Western music are Do–Re–Mi–Fa–Sol–La–Ti-Do. A similar melodic notes in Indian music are alluded to as Sa-Re-Ga-Ma-Pa-Da-Ni-Sa. In western music, we imply them utilizing English letter alphabets– to be specific C, D, E, F, G, A, B, and C as shown in Figure 1.Any music can be represented using these symbols. A key is a set of seven notes collectively called a scale. The scale is built by a specific relationship between the notes depending on major or minor scale. In the scale, there are seven tones which are noted as C, D, E, F, G, A and B.
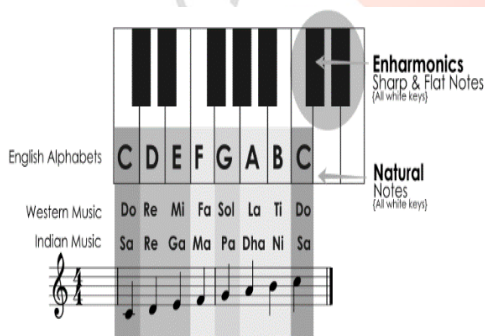

Figure 1. The Musical Notes of Western Music and Indian Music

The chromatic scale is a melodic scale with twelve pitches, each a semitone above or below its neighboring pitches comprising of sharp and flat notes. Sharp intends to go up a half advance, while flat intends to go down a half advance. Accordingly, in 12-pitch equivalent disposition (the most widely recognized temperament in Western music), the chromatic scale covers every one of the 12 of the accessible pitches as shown in Figure 2.
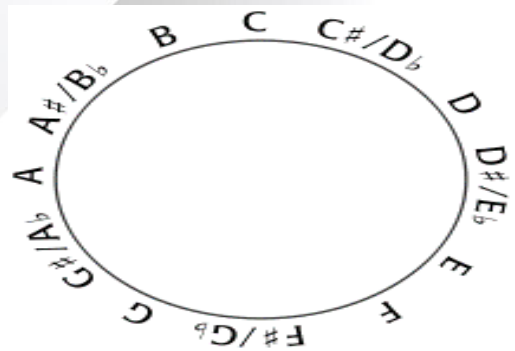

Figure 2. The Chromatic Scale

The basic construction of any scale is an association of whole steps and half steps. The steps are calculated using Melodic Intervals as when two notes appear one after the other, they create a melodic interval. A melody is basically a succession of melodic intervals arranged in a certain musical shape that makes sense to us.

LITERATURE REVIEW

Many researchers have involved with the researches incoperating some of the musical attributes with the Information Security. (Sandip Dutta, A Symmetric Key Algorithm for Cryptography using Music, 2013) Used Distinct frequencies for each and every English alphabet (A-Z) and digits (0-9) to encrypt a message which contains the upper alpha and numeric characters. Further (Sandip Dutta,

Hiding Messages using Musical Notes: A Fuzzy Logic Approach, 2015) uses some techniques which involves in the musical steganography. Most of the researches have done for a text message. Creation of different distinct forms of an attribute is used in encryption and Decryption.

METHODOLOGY AND EXPERIMENTAL DESIGN

Any permutation and combination of melodic notes may deliver some kind of music. Music structure comprises of a lot of rules and language grammar (M. Yamuna). Here we propose a technique to ensure security of any message utilizing the conventional western melodic English letters as a stego object. In the proposed strategy we apply encryption of bits utilizing a permuted music notation where the bits produce a cipher text that is covered up as far as music notes. Here, we select a key of length n (n<12) permuted arrangement of 12 chromatic musical notes as a key for encryption and decryption

Algorithm for Encryption
Step 1: Select your Message (M) to be sent.
Step 2: Convert your Message (M) into the binary Format (B1).
Step 3: Select the Key (K) to be used in the Ciphering Process.
Step 4: Convert Your Bit Format (B1) to a Musical File (Mf) with Musical Notes. Each Bit is Computed to a single musical note by analysing the bit (1 or 0) and the musical note is selected according to the Full/ Whole tone or Half/Semi tone.
Step 5: The Musical File (Mf) will be encoded into binary format (B2) and it will be transmitted through Public Network by performing normal standard Encryption.

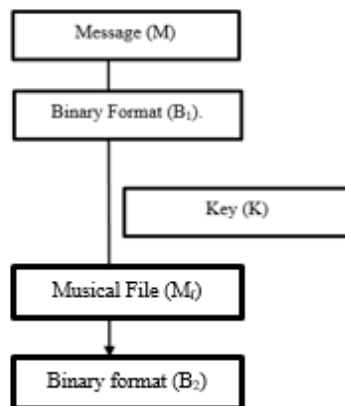The steps involved in encryption are illustrated in the Figure 3 below

Figure 3. Encryption Process

Algorithm For Decryption
Step 1: Get the Binary Formatted (B2) Message which undergoes normal standard decryption.
Step 2: The Musical File (Mf) will be obtained from the bit decoding process.
Step 3: Process the Key (K) to be used in the Deciphering Process.
Step 4: Convert Your Musical File with Musical Notes (Mf) to a Bit Format (B1). The Musical File (Mf) will Populate its own musical notes as used in Encryption Process.
Step 5: The binary format (B1) will be decoded into the Message (M)

The steps involved in Decryption are illustrated in the figure 4 below.
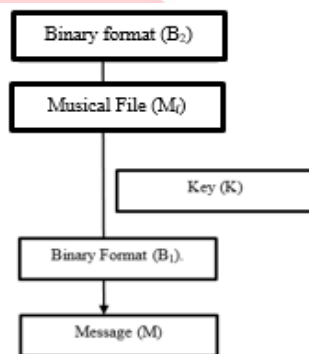

Figure 4. Decryption Process

RESULTS AND DISCUSSIONS

The Manipulation of Encryption Process is shown below with sample illustration.

- The Message to be sent: HI
- Each Letters ASCII code is considered in encoding to Binary format.0100100001001001

- The Key used in Ciphering: ABC#DFGA#

- The Musical Notes (music file) will be Computed: If the bit is 1 is will computed as Full/Whole tone, else it will compute as Semi/Half tone.
  ABDFGABC#DFA#ABDFGA

- The Music File will be encoded to a bit formatted message (Sampling and Quantizing) to be transmitted through the Public Network with the standard encryption Systems.

The Decryption is Processed in the Vice Versa. The algorithm utilizes the combining security mechanisms by utilizing the encryption and steganography (The message is hided in the format of music) utilizing the traits of music. By this, the guarantee the security of communication over an open channel is enhanced, which makes it hard to recognize the data passing through the network. Depending upon the bit design they are encoded utilizing the key, the aftereffects of the encryption procedure were found very satisfactory as far as aesthetic intrigue. The encoded message as a melodic piece we saw as progressively practical, the intruder cannot figure the melodic piece as a encoded message. The key utilized in encryption and decryption is certainly not a simple one to one substitution so speculating the key is difficult by and by. Through the Implementation of the proposed algorithm, a secure and hidden layer is manipulated in the transmission Process.

CONCLUSIONS

Cryptography and steganography are the two most extreme significant procedures in Information security today. This study investigated combining music and its traits to make musical cryptography and musical steganography mechanisms. To accomplish this, we used the classical music theory and a cipher based function to the bit pattern.

REFERENCES

Chandan Kumar, S. D. (2014). Musical Cryptography using Genetic Algorithm. 2014 International Conference on Circuit, Power and Computing Technologies [ICCPCT], (pp. 1742-1747).

M. Yamuna, K. P. (n.d.). CRYPTOGRAPHY USING MUSIC NOTES. Journal of Global Research in Computer Science.

Sandip Dutta, C. K. (2013). A Symmetric Key Algorithm for Cryptography using Music. International Journal of Engineering and Technology (IJET), 3109-3115.

Sandip Dutta, C. K. (2015). Hiding Messages using Musical Notes: A Fuzzy Logic Approach. International Journal of Security and Its Applications, 237-248.