Manipulation Vigenere Cipher Algorithm with Vernam Cipher through Matrix Table Rotation

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Abstract: Delivery of data is done by online are particularly vulnerable to be hacked by the owner of interests. The combination of Vernam Cipher and One Time Pad and its manipulation expected to be able to prevent hacking of data. Vernam cipher method works with plaintext is combined with streamkey (randompseudo) of the same length to produce a temporary ciphertext, One Time Pad method works by giving special conditions on the key used which is made of characters or letters are random (random keys or pad), and its randomization is not using a specific formula. One Time Pad encryption method is obtained by adding or subtracting the original text of the key. The combination and manipulation of these two algorithms were able to secure the data and returns back to its original form (plaintext), so it does not cause the integrity of the data is missing.

1 INTRODUCTION

We often use computer networks to interact or send a message in writing where there are a lot of confidential information that the data transmission process brings huge impact, that is security issues of data sent. Therefore, no good data transmission over a computer network in plain, but should be done security process for data to be sent, one way to do encryption on the data. Data security method used is cryptography, cryptography is one of security data that can be used to maintain the confidentiality of the data, as well as the authenticity of the sender. Currently very much the cryptographic algorithm that has been developed based on algorithms previously, one of them is the Vernam cipher algorithm in which use method of the one-time pad (OTP). One time pad method is very popular today due to the difficulty to guess the contents of the original message that was sent by the sender to the recipient. The Key length be the main factor that makes this algorithm is difficult to solve. The length of the key used is equal to the length of the plaintext which is randomly generated key of plaintext bits. However, the key length becomes a problem for a very long message in which the message sender must use the network completely safe in distributing the keys of course this also entails substantial costs as well as ensure the safety key.

In this paper we will be reviewed how the encryption process data by applying a one-time pad to encrypt the key and add a rotation algorithm to generate a new ciphertext by manipulating the Vernam Cipher algorithm. It aims to improve the security of data, so that the transmitted data is encrypted prior with a method that has been manipulated before being transmitted over the Internet network so that the data sent unknowable, modified or utilized by others who want to hack the data sent.

2 LITERATURE REVIEW

2.1 Cryptography

Any text or material outside the aforementioned margins will not be printed.

The word Cryptography is derived from the Greek,namely from word Cryptos meaning of the word hidden and graphein means writing. Cryptography can be interpreted as an art or a science which researched how the data is converted into a certain shape that is difficult to understand. Cryptography aims to maintain the confidentiality of information or data that can not be known by unauthorized parties (unauthorized person).

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2.1.1 Cryptography Components

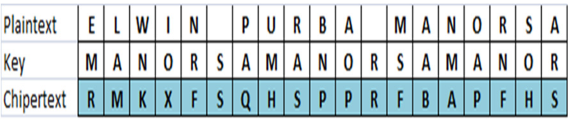
Basically, the cryptographic component consists of several components, such as:

1. Encryption: is very important in cryptography, is a way of securing the transmitted data that are kept confidential. The original message is called plaintext, which is converted into code that is not understood. Encryption can be interpreted with a cypher or code. Similarly, do not understand a word then we will see it in a dictionary or glossary. Unlike the case with encryption, to convert plain text into text-code we use algorithms to encode the data that we want.
2. Decryption: is the opposite of encryption. The encrypted message is returned to the original form (original text), called the message encryption algorithm used for encryption is different from the algorithm used for encryption.
3. Keywords: that means here is the key used for encryption and description.

Security of cryptographic algorithms depending on how the algorithm works, therefore this kind of algorithm is called finite algorithm. Limited algorithm is an algorithm used a group of people to keep the messages they send.

2.2 Vigenere Chiper

The Vigenère cipher is a method of encrypting alphabetic text by using a series of different Caesar ciphers based on the letters of a keyword. It is a simple form of polyalphabetic substitution. The characters used in the Cipher Vigenere that is A, B, C, ..., Z and united with the numbers 0, 1, 2, ..., 25. The encryption process is done by writing the key repeatedly. Writing the key repeatedly performed until each character in messages have a couple of key characters. Furthermore, the characters in the message is encrypted using the Caesar Cipher key values that have been paired with numbers. The Confederacy's messages were far from secret and the Union regularly cracked their messages. Throughout the war, the Confederate leadership primarily relied upon three key phrases, "Manchester Bluff", "Complete Victory" and, as the war came to a close, "Come Retribution". The table below show the example of encription using Vigenere Chiper consist of Plaintext, Key and Chipertext.



Plaintext	E	L	W	I	N		P	U	R	B	A		M	A	N	O	R	S	A
Key	M	A	N	O	R	S	A	M	A	N	O	R	S	A	M	A	N	O	R
Chipertext	R	M	K	X	F	S	Q	H	S	P	P	R	F	B	A	P	F	H	S

Figure 1 Examples Using Encryption Vigenere Cipher (Bruen, 2005)

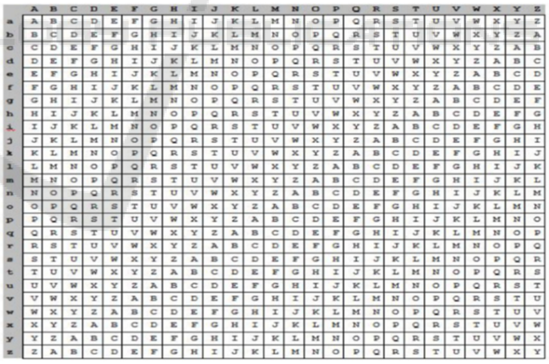
Examples of encryption in Figure 1, the message character "**E**" is encrypted with a key "**M**" and generate cipher text "**R**". The results obtained from the code encrypting the message "**E**" is worth **5** and a key character "**M**" which is worth **13**. Each character value added **5 + 13 = 18**. Because **18** is less than the **26** which is the number of characters used, then **18** divided by **26**. The rest of the division is **18** which is a character "**R**". The encryption process can be calculated by the following equation (Stalling, 2011):

$$Ei=(Pi+Ki)\ mod\ 26 \quad (2.0)$$

Where Ei, Pi and Ki an encrypted character, the character of the message and the character key. While the decryption process can use the following equation:

$$Di=(Ci-Ki)\ mod\ 26 \quad (2.1)$$

With Di is the result of the decryption code, Ci is character cipher text or cipher, Ki is a key character. While other methods to perform the encryption process with Vigenere Cipher method that uses tabula recta (also called Vigenere square).



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
a	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
b	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A
c	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B
d	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C
e	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D
f	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E
g	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F
h	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G
i	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H
j	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I
k	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J
l	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K
m	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L
n	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M
o	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N
p	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
q	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
r	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
s	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
t	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
u	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
v	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
w	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
x	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
y	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
z	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y

Figure 2: Tabula recta Vigenere algorithm

The leftmost column of squares states key letters, while the top line states **plaintext letters**. Each line in the rectangle states the **letters ciphertext** obtained by Caesar Cipher, in which the number of shifts letter plaintext specified numerical values of letters that key (**ie, a = 0, b = 1, c = 2, ..., z = 25**) ,Vigenère square is used to obtain the ciphertext by using a key that has been determined. If the key length is shorter than the length of the plaintext, then the keyare repeatedit's use (the periodic system). When the key length is **m**, then the period is said to be **m**.

2.3 Vernam Chiper

Cryptography for most people is something that is very difficult and we as beginners tend to be lazy to learn it. However there is a cryptographic method that is rather easy to learn and the experts have stated that this method is a cryptographic method that is safe enough to use. The method is commonly known by the name of One Time Pad (OTP) or better known as the Vernam Cipher. Vernam Cipher invented by Major J.Maugborne and G. Vernam in 1917. Algorithms One Time Pad (OTP) is a diversified symetric key algorithm, which means that the key used to encrypt and decrypt the same key. In the process of encryption, algorithm it uses the stream cipher derived from the XOR between bits of plaintext and key bits. In this method, the plain text is converted into ASCII code and then subjected to an **XOR** operation on the key that has been converted into ASCII code.

2.4 On Time Pad

One-time pad (OTP) is a stream cipher to encrypt and decrypt one character each time. This algorithm was found in 1917 by Major Joseph Mauborgne as improvement of Vernam Cipher to produce a perfect security. Mauborgne proposes the use of One-Time Padcontaining a row of characters randomly generated key. One pad is used only once (one-time) only to encrypt a message, after the pad has been used demolished so as not be reused for other encrypting messages. Encryption can be expressed as the sum modulo 26 of the plaintext character with one key character one-time pad. This is the equation of one-time pad encryption 26 characters shown in Equation 2.2 below:

$$C_i = (P_i + K_i) \bmod 26 \quad (2.2)$$

If the character that is used is a member of the set of 256 characters (such as characters with ASCII encoding), then the encryption equation shown in equation 2.3 below.

$$P_i = (C_i - K_i) \bmod 26 \quad (2.3)$$

After the sender encrypts the message with the key, he destroyed the key. Recipient of the message using the same pad to decrypt the ciphertext characters into characters plaintext with equation 2.4 below.

$$P_i = (C_i - K_i) \bmod 26 \quad (2.4)$$

for the 26-letter alphabet, or for the 256-character alphabet with equation 2.5 below.

$$P_i = (C_i - K_i) \bmod 256 \quad (2.5)$$

The ways of working one time pad method:

$$C = P \text{ XOR } K \quad (2.6)$$

$$P = C \text{ XOR } K \quad (2.7)$$

Note that the key length should be equal to the length of the plaintext, so there is no need to repeat the use of the key during the encryption process (as in vernam cipher).

2.5 Rotation Matrix

Rotation matrix is shifting ciphertext character that has been incorporated into the matrix column clockwise, along the defined distance of the key. How to determine the length of shifts and the number of shifts can be seen in the following table below:

Table 1. Calculation of Long Shifts in Matrix

Ki	M	A	N	O	R	S	A	
A = Dec(Ki)	77	65	78	79	82	83	65	(2.8)
B = A+C_{n-1}	76	90	91	79	83	87	70	(2.9)
C = A mod 26	25	13	0	1	4	5	13	(2.10)
D = B+C mod 26	23	25	13	2	9	14	5	(2.11)
Char	W	Y	M	B	I	N	E	
G = Dec(Char)	87	89	77	66	73	78	69	(2.12)
Rg = G mod 26	9	11	25	14	21	0	17	(2.13)

Explanation:

Ki : Key

A : Decimal ASCII value of the key characters

B : Results Summation with a decimal value key with the previousresult (C).

C : The decimal value of a key character mod 26

D : Number of B + C mod 26

Char : The result of the shift in the index table alphabetic characters as much as the value of D

G : Decimal ASCII value of the key characters

Rg : Long shifts in the character matrix table

Whereas for the amount of shift is determined by the character key

3 METHOD

Forms of research conducted by the authors in this paper is a review of literature. The literature review is a framework, concepts, or orientation to perform the analysis and classification of facts collected in a study. Referral sources from books and journals, which are referred to in this paper are directly related to the object under researched, that is the plaintext encryption. The method of research that used in this paper is a flowchart. This method includes determining a model of encryption, the completion of the encryption algorithm, encryption simulation manufacture and analysis of simulation results encryption. Flowchart design simulations on complete this researchcan be seen in Figure 3

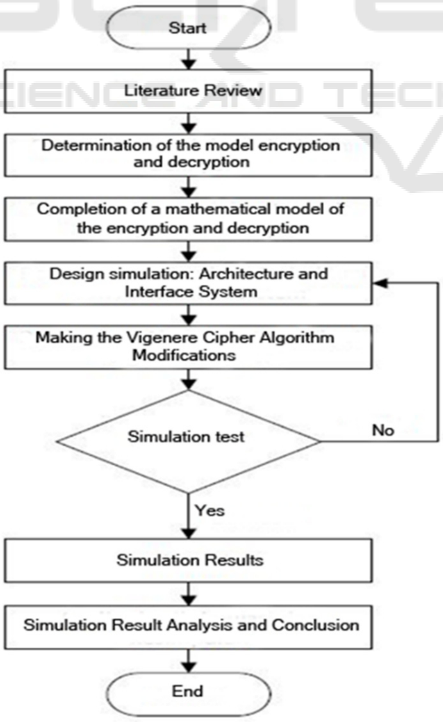

Start
Literature Review
Determination of the model encryption and decryption
Completion of a mathematical model of the encryption and decryption
Design simulation: Architecture and Interface System
Making the Vigenere Cipher Algorithm Modifications
Simulation test
No
Yes
Simulation Results
Simulation Result Analysis and Conclusion
End

Figure 3. Flowchart Modification Research Vigenere Ciphe

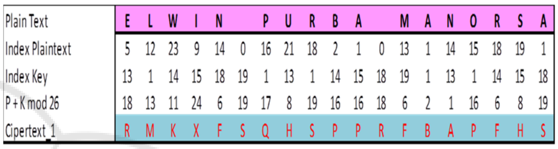
4 RESULT

4.1 Encription

Vigenere Cipher

Encryption on the principle of the algorithm is to combine each character in the plaintext with the characters on the keys. Therefore, the key length must be at least equal to the length of the plaintext. In the first stage plaintext change them into first ciphertextby using a key.If the plaintext length exceeds the length of the key, then the key will be written repeatedly. Vigenere Cipher encryption algorithm process can be seen in the following figure:

Plaintext	: ELWIN PURBA MANORSA
Key	: MANORSAMANORSAMANOR
Cipherteks	: RMKXFSQHSPPRFBAPFHS

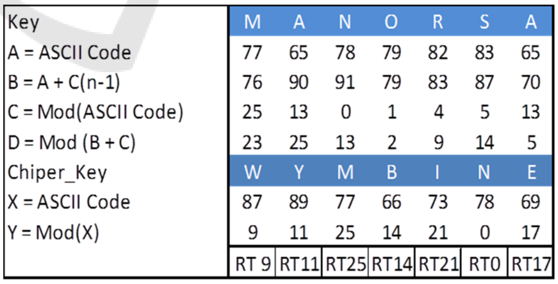


Plain Text	E	L	W	I	N		P	U	R	B	A		M	A	N	O	R	S	A
Index Plaintext	5	12	23	9	14	0	16	21	18	2	1	0	13	1	14	15	18	19	1
Index Key	13	1	14	15	18	19	1	13	1	14	15	18	19	1	13	1	14	15	18
P + K mod 26	18	13	11	24	6	19	17	8	19	16	16	18	6	2	1	16	6	8	19
Cipertext_1	R	M	K	X	F	S	Q	H	S	P	P	R	F	B	A	P	F	H	S

Figure 4:Table Testing of Encryption Vigenere Cipher

Rotation Key Algorithm

Rotation key generation algorithm aims to improve the security of the plaintext by changing the keys into a new character. Furthermore, the new character is converted to decimal and then look for the value of the modulation to determine the length of a shift towards the characters in the matrix table.Consider the following figure.



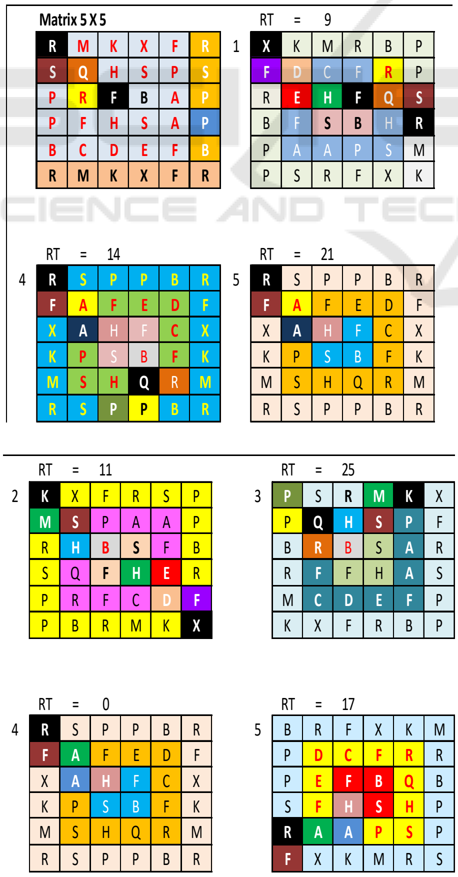
Key	M	A	N	O	R	S	A
A = ASCII Code	77	65	78	79	82	83	65
B = A + C(n-1)	76	90	91	79	83	87	70
C = Mod(ASCII Code)	25	13	0	1	4	5	13
D = Mod (B + C)	23	25	13	2	9	14	5
Chiper_Key	W	Y	M	B	I	N	E
X = ASCII Code	87	89	77	66	73	78	69
Y = Mod(X)	9	11	25	14	21	0	17
	RT 9	RT11	RT25	RT14	RT21	RT0	RT17

Figure 5: Process Key Algorithm determining Long Shifts on Matrix rotation

Rotation algorithm

In this process, all the characters ciphertext that has been generated on Vigenere Cipher algorithm written into the matrix table where condition matrix which must consist of a matrix of squares, where the number of rows equals the number of columns. To run this algorithm, first consider the following steps.

1. Write down all of the ciphertext into the matrix
2. The matrix will be formed must consist of the same number of rows and columns.
3. To define a matrix of rows and columns calculate the amount of n ciphertext;n = length of ciphertext.
4. If **0<n <= 9**, it will form a **3 x 3** matrix.
   If **9<n<= 16**, it will form a matrix of **4 x 4**
   If **16<n<= 25**, it will form a matrix of **5 x 5,** etc.
5. If the matrix column empty, fill it with the alphabet from A until the empty column full of character.
6. Copy the first column then make a new ending column
7. After that copy the first line and then make a new ending line.
8. Make the first shift in which the shift length is determined by the rotation of key algorithms. Rotation matrix will end after reaching n MAX of keys.



Matrix 5 X 5

R	M	K	X	F	R
S	Q	H	S	P	S
P	R	F	B	A	P
P	F	H	S	A	P
B	C	D	E	F	B
R	M	K	X	F	R

RT = 9

1

X	K	M	R	B	P
F	D	C	F	R	P
R	E	H	F	Q	S
B	F	S	B	H	R
P	A	A	P	S	M
P	S	R	F	X	K

RT = 14

4

R	S	P	P	B	R
F	A	F	E	D	F
X	A	H	F	C	X
K	P	S	B	F	K
M	S	H	Q	R	M
R	S	P	P	B	R

RT = 21

5

R	S	P	P	B	R
F	A	F	E	D	F
X	A	H	F	C	X
K	P	S	B	F	K
M	S	H	Q	R	M
R	S	P	P	B	R

RT = 11

2

K	X	F	R	S	P
M	S	P	A	A	P
R	H	B	S	F	B
S	Q	F	H	E	R
P	R	F	C	D	F
P	B	R	M	K	X

RT = 25

3

P	S	R	M	K	X
P	Q	H	S	P	F
B	R	B	S	A	R
R	F	F	H	A	S
M	C	D	E	F	P
K	X	F	R	B	P

RT = 0

4

R	S	P	P	B	R
F	A	F	E	D	F
X	A	H	F	C	X
K	P	S	B	F	K
M	S	H	Q	R	M
R	S	P	P	B	R

RT = 17

5

B	R	F	X	K	M
P	D	C	F	R	R
P	E	F	B	Q	B
S	F	H	S	H	P
R	A	A	P	S	P
F	X	K	M	R	S

Figure 6: Process of Rotation Matrix

4.1.1 Retrieved End Cipertext: BRFXKMPDCFRRPEFBQBSFHSHP RAAPSPFXKMRS

Vernam Cipher

Encryption can be expressed as the result of the Exclusive OR (XOR) of the plaintext character with an OTP key characters.This algorithm acts to encrypt the plaintext where the key is generated randomly. This key is valid only disposable where if you want to decrypt the same message then the generated key will be changed.

One Time Pad

In this method, there are two things that need to be encrypted is the key and the ciphertext obtained from vigenere chipper.This method works in advance ischange the main key with One Time Pad methodeto produce the Ciphertext of the key then this key will be the **second key** or a **new key**.

Ei : Pi XOR Ki

The main key : MANORSA
Random key :
Key Ciphertext : "€ +« "n%

Plaintext	Binary Bit	Random Bit	XOR	Key
M	01001101	11100101	10101000	“
A	01000001	11000001	10000000	€
N	01001110	01100101	00101011	+
O	01001111	11100100	10101011	«
R	01010010	11111010	10101000	“
S	01010011	00111101	01101110	n
A	01000001	01100100	00100101	%

Figure 7: Encryption Results of Main Key

The next new key that has been generated is used to encrypt the ciphertext that has been obtained from vigenere cipher.

From the results of the main key encryption in the previous process we obtain a new key and then the key is repeated until the key length equal to the length of the plaintext.The result of the encryption of the plaintext and the key will be the end of the process to produce a strong ciphertext.

Plaintext : BRFXKMPDCFRRPEFBQBSFHSHPRAAPSPFX KMRS
Key : “€+«“n%“€+«“n%“€+«“n%“€+«“n%“€+«“n%“

Ciphertext :
ÛÊm¾Ò#uý ├m¨·>`¯┬zÚ¹(m¹╚{¨Ú/u¹ðm¾Ò#w¹

The encryption process is represented in binary form:

Pi : 01000010 01010010 01000110 01011000 01001011 01001101
Ki : 10101000 10000000 00101011 10101011 10101000 01101110
Ci : 11101010 11010010 01101101 11110011 11100011 00100011

Pi : 01010000 01000100 01000011 01000110 01010010 01010010
Ki : 00100101 10101000 10000000 00101011 10101011 10101000
Ci : 01110101 11101100 11000011 01101101 11111001 11111010

Pi : 01010000 01000101 01000110 01000010 01010001 01000010
Ki : 01101110 00100101 10101000 10000000 00101011 10101011
Ci : 00111110 01100000 11101110 11000010 01111010 11101001

Pi : 01010011 01000110 01001000 01010011 01001000 01010000
Ki : 10101000 01101110 00100101 10101000 10000000 00101011
Ci : 11111011 00101000 01101101 11111011 11001000 01111011

Pi : 01010010 01000001 01000001 01010000 01010011 01010000
Ki : 10101011 10101000 01101110 00100101 10101000 10000000
Ci : 11111001 11101001 00101111 01110101 11111011 11010000

Pi : 01000110 01011000 01001011 01001101 01010010 01010011
Ki : 00101011 10101011 10101000 01101110 00100101 10101000
Ci : 01101101 11110011 11100011 00100011 01110111 11111011

The encryption process with the one-time pad method

The results of encryption on this method obtain ciphertext to be sent to the recipient where there are two keys that are sent, among others, the key to decrypt the plaintext and the key to decrypt the key.

4.2 Description

One Time Pad

To know the plaintext from the ciphertext received by the rightful recipient of the message, that is by first using the one-time pad method.The message recipients require a new key as a reference to recover the plaintext.

Ciphertext :
ÛÊm¾Ò#uý ├m¨·>`¯┬zÚ¹(m¹╚{¨Ú/u¹ðm¾Ò#w¹
New Key : “€+«“n%

Ciphertext and the key then is XORed using the formula:
Di : Ci XOR Ki

The process of the message recipient to get a new message that is still in the form of Ciphertextare: BRFXKMPDCFRRPEFBQBSFHSHPRAAPSPFX KMRS.
After successful decryption of the message recipient to decrypt back to find out the main key is still the one-time pad method.
Ciperteks key : “€+«“n%
Key : åÁeäú=d

Main Key = Ci XOR Ki
“ : 10101000 XOR å : 11100101 = 01001101 : M
€ : 10000000 XOR Á : 11000001 =01000001 : A
+ : 00101011 XOR e : 01100101 =01001110 : N
« : 10101011 XOR ä : 11100100 =01001111 : O
“ : 10101000 XOR ú : 11111010 =01010010 : R
N : 01101110 XOR = : 00111101 =01010011 : S
% : 00100101 XOR d : 01100100 =01000001 : A

Main Key : MANORSA

Rotation algorithm

The next decryption algorithm is an algorithm in which the rotation that has been encrypted ciphertext of the previous methods to be put into a matrix table. See the figure below.
Ciphertext :
BRFXKMPDCFRRPEFBQBSFHSHPRAAPSPFX KMRS

B	**R**	F	X	K	M
P	**D**	C	F	R	R
P	E	F	B	Q	B
S	F	**H**	S	H	P
R	**A**	**A**	P	S	P
F	X	K	M	R	S

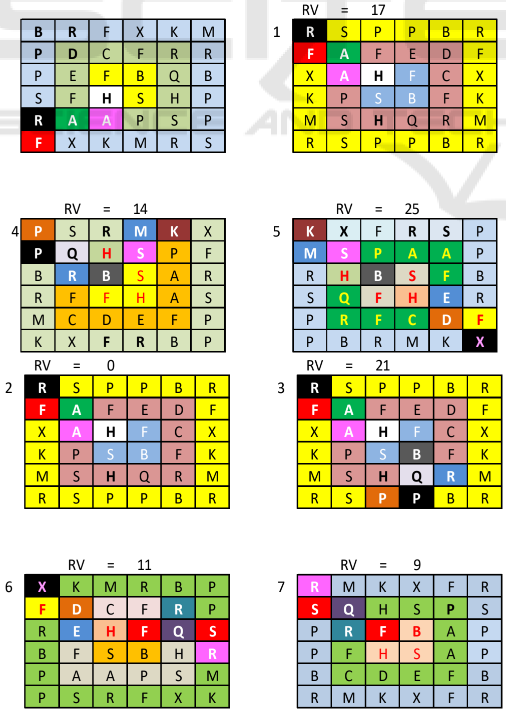
Figure 8: Matrix Ciphertext

In the previous encryption process, ciphertext character that is in the column of the matrix are moved forward along key value, but on the decryption algorithmciphertext character that is in the matrix table is sliding backwards or revers along key value and repeated as much as the key length. The key value is obtained from the following process :

Key	M	A	N	O	R	S	A
A = ASCII Code	77	65	78	79	82	83	65
B = A + C(n-1)	76	90	91	79	83	87	70
C = Mod(ASCII Code)	25	13	0	1	4	5	13
D = Mod (B + C)	23	25	13	2	9	14	5
Chiper_Key	W	Y	M	B	I	N	E
X = ASCII Code	87	89	77	66	73	78	69
Y = Mod(X)	9	11	25	14	21	0	17
	RT 9	RT11	RT25	RT14	RT21	RT0	RT17

Figure 9: The process of determining the value of the key

After a successful key value is determined next process is to do a rotation matrix algorithm.



B	**R**	F	X	K	M
P	**D**	C	F	R	R
P	E	F	B	Q	B
S	F	**H**	S	H	P
R	**A**	**A**	P	S	P
F	X	K	M	R	S

RV = 17

1

R	S	P	P	B	R
F	**A**	F	E	D	F
X	**A**	**H**	F	C	X
K	P	S	B	F	K
M	S	**H**	Q	R	M
R	S	P	P	B	R

RV = 14

4

P	S	**R**	**M**	**K**	X
P	**Q**	H	S	P	F
B	**R**	**B**	S	A	R
R	F	F	H	A	S
M	C	D	E	F	P
K	X	**F**	**R**	B	P

RV = 25

5

K	**X**	F	**R**	**S**	P
M	**S**	**P**	**A**	**A**	P
R	**H**	**B**	**S**	**F**	B
S	**Q**	**F**	**H**	**E**	R
P	**R**	**F**	**C**	**D**	**F**
P	B	R	M	K	**X**

RV = 0

2

R	S	P	P	B	R
F	**A**	F	E	D	F
X	**A**	**H**	F	C	X
K	P	S	B	F	K
M	S	**H**	Q	R	M
R	S	P	P	B	R

RV = 21

3

R	S	P	P	B	R
F	**A**	F	E	D	F
X	**A**	**H**	F	C	X
K	P	S	**B**	F	K
M	S	**H**	**Q**	**R**	M
R	S	**P**	**P**	B	R

RV = 11

6

X	K	M	R	B	P
F	**D**	C	F	**R**	P
R	**E**	**H**	**F**	**Q**	**S**
B	F	S	B	H	**R**
P	A	A	P	S	M
P	S	R	F	X	K

RV = 9

7

R	M	K	X	F	R
S	**Q**	H	S	**P**	S
P	**R**	**F**	**B**	A	P
P	F	H	S	A	P
B	C	D	E	F	B
R	M	K	X	F	R

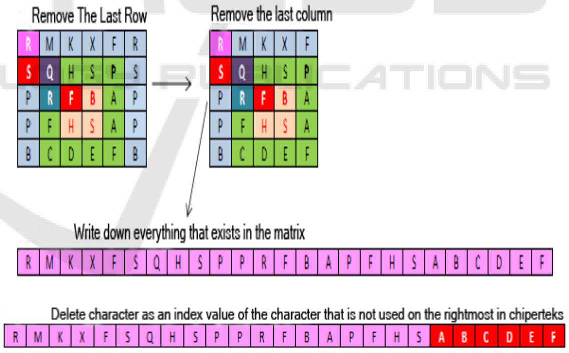
Figure 10: Process Description ciphertext with Matrix Ciphertext Algorithm

The results of the first rotation indicated at number one in the previous figure 10 wherein **R** is on the line five-column one. If we look at previous matrix characters that are in row one column one is **B**, then calculated spin clockwise as key values obtained from the previous process. The key value is taken values that are at the end of the index is **17**,the next process is the value at the previous indexup until the beginning of the index, this is certainly the opposite of encryption algorithms. Having calculated the characters are on the order of **17** is **R**then **R** is placed on row one column one on the following matrix and is followed by the next character, then repeated continuously until the last process.In the process of this algorithm obtained the final matrix below:

R	M	K	X	F	R
S	**Q**	H	S	**P**	S
P	**R**	**F**	**B**	A	P
P	F	H	S	A	P
B	C	D	E	F	B
R	M	K	X	F	R

Figure 11: The Results of Algorithm Rotation Matrix

The next stage remove the last row and the last column of the matrix



Remove The Last Row

R	M	K	X	F	R
S	Q	H	S	P	S
P	R	F	B	A	P
P	F	H	S	A	P
B	C	D	E	F	B

Remove the last column

R	M	K	X	F
S	Q	H	S	P
P	R	F	B	A
P	F	H	S	A
B	C	D	E	F

Write down everything that exists in the matrix

R	M	K	X	F	S	Q	H	S	P	P	R	F	B	A	P	F	H	S	A	B	C	D	E	F

Delete character as an index value of the character that is not used on the rightmost in chiperteks

R	M	K	X	F	S	Q	H	S	P	P	R	F	B	A	P	F	H	S	A	B	C	D	E	F

The Ciphertext become :

R	M	K	X	F	S	Q	H	S	P	P	R	F	B	A	P	F	H	S

AlgoritmaVigenere

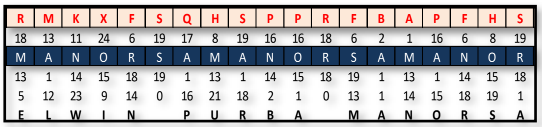
Last decryption algorithm using the algorithm vigenere cipher by using the key with formula:

Di = (Ci – Ki) mod 26

So the result we can see below:

Ciphertext : RMKXFSQHSPPRFBAPFHS
Key : MANORSAMANORSAMANOR

Plaintext : ELWIN PURBA MANORSA



R	M	K	X	F	S	Q	H	S	P	P	R	F	B	A	P	F	H	S
18	13	11	24	6	19	17	8	19	16	16	18	6	2	1	16	6	8	19
M	A	N	O	R	S	A	M	A	N	O	R	S	A	M	A	N	O	R
13	1	14	15	18	19	1	13	1	14	15	18	19	1	13	1	14	15	18
5	12	23	9	14	0	16	21	18	2	1	0	13	1	14	15	18	19	1
E	L	W	I	N		P	U	R	B	A		M	A	N	O	R	S	A

5 CONCLUSION

Arch is still modest or simple, but is expected to be useful as a first step to enter into the world of cryptography,particularly in the implementation of message security algorithms using other combinations. To the future, this research is expected to be developed,used and applied in the areas of life that is more complex.

REFERENCES

Moore, R., Lopes, J., 1999. Paper templates. In *TEMPLATE'06, 1st International Conference on Template Production*. SCITEPRESS.

Smith, J., 1998. *The book*, The publishing company. London, 2nd edition.

Bruce Schneier (1996). "Applied Cryptography 2nd edition Source Code in C".John Wiley & Sons.

Bruen, Aiden A. &Forcinito, Mario A. (2011). *Cryptography, Information Theory, andError-Correction: A Handbook for the 21st Century* (http://books.google.com/books?id=fd2LtVgFzoMC&pg=PA21). John Wiley & Sons.p. 21.ISBN 978-1-118-03138-4.

David, Kahn (1999). *"Crises of the Union"*. The Codebreakers: The Story of Secret Writing. Simon & Schuster. pp. 217–221. ISBN 0-684-83130-9.

*Vernam, Gilbert S. (1926), "Cipher Printing Telegraph Systems For Secret Wire and Radio Telegraphic Communications", Journal of the IEEE, **55**: 109–115*

SharadPatil , Ajay Kumar:*Effective Secure Encryption Scheme(One Time Pad) using Complement Approach-*International Journal of Computer Science & Communication, Vol.1,No.1,January-June 2010,pp.229-233.

Jonathan Katz , Yehuda Lindell *: Introduction to Modern Cryptography,Chapman&Hall/CRC Taylor & Francis Group*