JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. IX No 1, Desember 2022, hlm. 83 - 90 ISSN 2550-0201 (Online)
DOI: https://doi.org/10.33330/jurteksi.v9i1.1890
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

INTEGRATED NETWORK SYSTEM SECURITY TO DETERMINE GIS (GEOGRAPHIC INFORMATION SYSTEM) BASED CYBER CRIME PATTERNS

Dely Indah Sari[1*], Muhammad Jufri[1]
Teknik Komputer, Sistem Informasi Institut Teknologi Batam
email: *deli@iteba.ac.id, jufri@iteba.ac.id

Abstract: crime mapping, namely by examining various spatial data factors that can be integrated to be able to produce a variety of information for security officers and the government in an effort to realize security in an area by utilizing geographic information systems by mapping, visualizing and analyzing crime incidents so that Various patterns and trends of spatial and temporal crime are generated using the main concept of cryptography, namely the encryption or encryption process where the plaintext encoding process becomes ciphertext and the decryption or description process, which is the process of returning the ciphertext to the original plaintext using the Electronic Code Book (ECB) algorithm and the ECB algorithm vigenere

Keywords: criminal patterns, geographic information systems, network system

Abstrak: pemetaan kriminalitas yaitu dengan mengkaji berbagai macam faktor data spasial yang dapat terintegrasi untuk dapat menghasilkan keanekaragaman informasi bagi aparat keamanan dan pemerintah dalam upaya mewujudkan kemanan di suatu area dengan memanfaatkan sistem informasi geografis dengan cara dilakukan memetakan, memvisualkan dan menganalisis insiden kriminalitas sehingga dihasilkan beragam pola maupun trend kriminalitas secara spasial temporal dengan menggunakan konsep utama dari kriptografi yaitu proses enkripsi atau enkription dimana proses penyandian plainteks menjadi cipherteks dan proses dekripsi atau description yaitu proses mengembalikan cipherteks menjadi plainteks semula menggunakan algoritma Elektronic Code Book (ECB) dan algoritma Vigenere.

Kata kunci: pola kriminalitas, sistem informasi geografis, sistem keamanan

JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. IX No 1, Desember 2022, hlm. 83 - 90 ISSN 2550-0201 (Online)
DOI: https://doi.org/10.33330/jurteksi.v9i1.1890
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

INTRODUCTION

Cyber Crime is an effort or action that violates legal norms that can be carried out by one or more people so that it can cause losses in the form of loss of property, create fear and trauma and can also result in loss of life. There are various kinds of motives that underlie the level of social and economic tribality. Based on the 2021 criminal statistics, there are 294,281 incidents of crime (total crime) in 2018 and a decrease of 269,324 incidents in 2019 and a decrease in 2020 to 247,218 incidents during the period 2018-2020. fluctuate.[1] There are areas that have the highest number of cases of several types of crimes committed in Indonesia originating from the Indonesian National Police where the highest crimes related to embezzlement are in the North Sumatra Police with 2,545 cases, corruption-related crimes are in the Java Police. East Nusa Tenggara as many as 47 incidents, the highest crime related to public order at the East Nusa Tenggara Police with 827 incidents, the highest crime related to fraud/cheating at the Metro Jaya Police with 3,303 incidents, crimes in the Riau Islands as many as 2,843 crimes ranked third. Nine crimes, crimes in West Java as many as 11,256 crimes and ranks sixth crime.

Based on these data, crime mapping is carried out in the geographic information system by examining various spatial data factors that can be integrated to be able to produce a diversity of information for security forces and the government in an effort to realize security in an area by utilizing geographic information systems by mapping. , visualize and analyze criminal incidents so that various patterns and trends of crime are produced in a spatial and temporal manner.

In the era of modern communication technology, it will have various impacts on the dynamics of human life, both in the dynamics of the real world and the dynamics of the virtual world, so that it can have an impact in the form of transactions and digital communications, this of course can have both positive and negative impacts.[2] This results in data and information having a value whose object is ownership so that it must be kept confidential. System security has become something that is very vulnerable to security disturbances, with there are systems that are indeed designed to be open, such as the internet, where there are no physical restrictions on internet users and their development is very fast, so there are demands for so that system security gets the main priority in ensuring the confidentiality of a data. Cryptography as a system security method that can be processed into messages that cannot be understood by other parties as a form of maintaining message security.[3]. There are three categories of interference that can be done to be able to hack data or information that is detrimental to users, namely efforts to gain access (access attacks) to various computer resources or data and information, both attacks to be able to make modifications (modification attacks) are carried out with efforts to gain access then by changing data and information illegally, the third attack to inhibit service providers (denial of service attack) by trying to disrupt computer networks. The way to carry out attacks is sniffing, where to avoid the negative effects of sniffing is to use cryptography.

JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. IX No 1, Desember 2022, hlm. 83 - 90 ISSN 2550-0201 (Online)
DOI: https://doi.org/10.33330/jurteksi.v9i1.1890
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

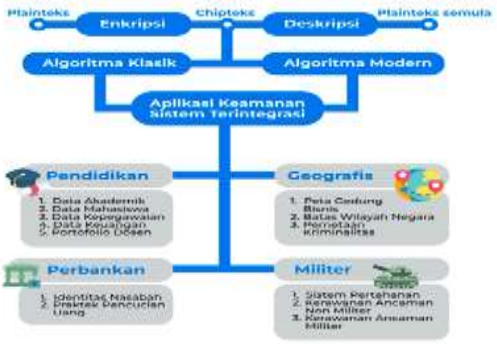

Image 1 Proses Enkripsi and Dekripsi

System security will be able to anticipate the phenomenon of crime which increases every year with the percentage of completion that is not directly proportional to the resolution of crime cases, requiring efforts and settlement strategies that can be integrated between geographic information systems and system security using cryptography. as a form of tackling crime in order to create and fulfill security in building a conducive atmosphere for the community to carry out various kinds of activities including economic and tourism activities, so that this condition on a macro scale will be able to create national stability which is a prerequisite for the achievement of development in the context of realizing a just and prosperous society.

Based on statistical data, crime is a key aspect that contributes to the fulfillment of the success of national development. With the creation and fulfillment of national security will create a conducive atmosphere so that problems can be formulated [4]. Utilization of criminal patterns in the observation of crime events with overlay analysis using cryptography. Crime mapping requires the suitability of location, time and target in geographic information systems using cryptography. There is no comprehensive information about the potential for criminality spatially and temporarily so that the apparatus cannot take preventive measures [5]

Image 4 The Highest Number of Cases Type of Crime

Mapping crime in a geographic information system can examine various spatial data factors that can be integrated to be able to produce a variety of information for security forces and the government in an effort to realize security in an area by utilizing a geographic information system by mapping, visualizing and analyzing crime incidents so as to produce a variety of spatial-temporal patterns and trends of crime. [6]

In the era of modern communication technology, it will have various impacts on the dynamics of human life, both in the dynamics of the real world and the dynamics of the virtual world, so that it can be impacked into the form of digital transactions and communications, this of course can have both positive and negative impacts. This results in data and information having a value which is the object of ownership so that it must be kept confidential

System security is something that is very vulnerable to security disturbances, with systems that are designed to be open like the internet, where there are no physical boundaries for internet users and the development is very fast so there is a demand that system security get top priority in guaranteeing confidentiality. a data.

Geographical information systems on criminal patterns consist of spatial data

JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. IX No 1, Desember 2022, hlm. 83 - 90 ISSN 2550-0201 (Online)
DOI: https://doi.org/10.33330/jurteksi.v9i1.1890
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

related to comprehensive information about potential criminality spatially-temporally so that the National Police as a security force can use this information as a reference in carrying out prevention both from an institutional perspective and jointly with the government and local communities. so that the use of the information system as part of a series of decisions in the field of security, especially in Indonesia.

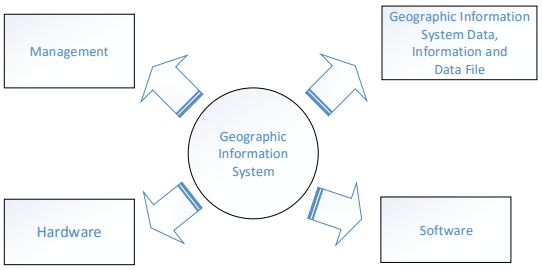

Image 5 Geographic Information System Components

The geographic information system it self is a tool for querying and analyzing, making accurate decisions and producing maps. In cryptographic research on integrated system security to determine GIS (geographic information system) based crime patterns, a pattern of crime is mapped in each region that has different patterns of crime. [7]

Crime mapping is where the process of encryption or encoding of plaintext is encoded into ciphertext and the process of decryption or description is the process of returning the ciphertext to the original plaintext with the process of mapping, visualizing and analyzing criminal incidents so that patterns and trends of crime are produced spatially and temporally that are standardized for data security. whether in the form of images, documents so that data security can be created from someone who does not have the eligibility to obtain this information .[8]

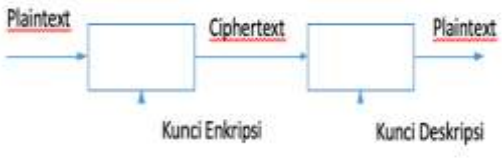

Image 2 Enkripsi and Dekripsi

Based on statistical data, crime is a key aspect that contributes to the fulfillment of the success of national development. By creating and fulfilling national security, it will create a conducive atmosphere for the community. The formulation of the problem is the use of criminality patterns in observing incidents by overlaying analysis using network system security. The aim of this research is how to use the pattern of cyber cream in observing crime incidents by overlaying analysis using integrated system security media so that parties who are not entitled to get this information cannot read the contents of the message sent.

There is a method used in this research is the Electronic Code Book (ECB) cryptographic algorithm. [9] and algoritma Vigenere [10]. The Vigenere algorithm is a development method of the Caesar ciphertext algorithm because each character in the plaintext has a shift with the same number of shifts but in the vigenere cipher algorithm each character is shifted by a different number of shifts from other algorithms.[11]

The use of the ECB algorithm is an encoding process where each plaintext is processed (P1) separately from one another, an XOR process is carried out with a certain Hexa key into a ciphertext block (C1) [12] with a mathematical model

JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. IX No 1, Desember 2022, hlm. 83 - 90 ISSN 2550-0201 (Online)
DOI: https://doi.org/10.33330/jurteksi.v9i1.1890
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

METHOD

The method use in this research have any step in problem data security is for identifikasi transmission data Data that is transmitted in the form of ciphertext is returned to plaintext, to read it only the person who has the right can return the ciphertext to plaintext. Encrypted data can be text documents, image documents and database documents, in analysis data security The design is carried out to simulate the most appropriate system security algorithm method to be able to produce a mathematical solution that fits the needs of an integrated system by prioritizing system security to maintain confidentiality so that message quality can handle security problems. Development of the Electronic Code Book (ECB) Algorithm and the Vigenere Algorithm Is an algorithm that has a series of bits that are broken down into bit blocks. Simulation Test This is a test carried out to find out whether the Electronic Code Book (ECB) Algorithm method and the Vigenere Algorithm are in accordance with the expected results or not.
Analysis of simulation results and conclusions namely analysis of the simulation results what are the obstacles so that improvements are made to the Electronic Code Book (ECB) Algorithm and the Vigenere Algorithm which can support the success of the Electronic Code Book (ECB) Algorithm and the Vigenere Algorithm in accordance with the theory

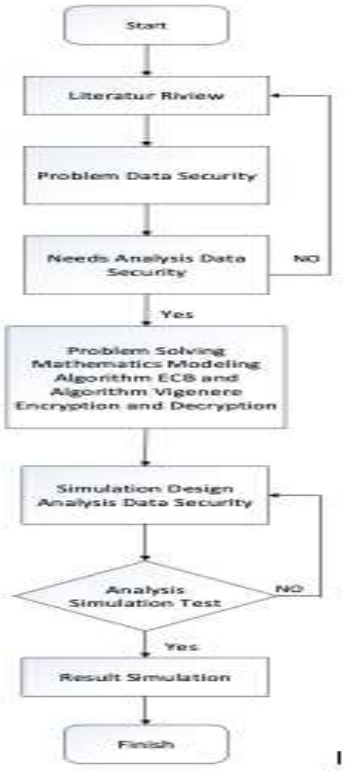

Image 3 Flowchart method Electronic Code Book (ECB)

Image 4 Encryption Scheme and Description of Block Cipher technique

In the ECB method, there are stages used so that it can form characters from the results of the encryption and decryption processes in each block.
Enkripsi = C1 = Ek (P1) ……(1)
Dekripsi = P1 = Dk (C1) ……...(2)
C1 is the i ciphertext
Pt is the ith plaintext

JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. IX No 1, Desember 2022, hlm. 83 - 90 ISSN 2550-0201 (Online)
DOI: https://doi.org/10.33330/jurteksi.v9i1.1890
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

Tabel 1. Biner and Hexa ASCII

Biner	Hexa	Biner	Hexa	Biner	Hexa
0000	0	0110	6	1100	C
0001	1	0111	7	1101	D
0010	2	1000	8	1110	E
0011	3	1001	9	1111	F
0100	4	1010	A		
0101	5	1011	B		

The vigenere algorithm is a method of encoding alphabetic text by using a series of Caesar ciphers based on the letters of the keyword. The Vigenere cipher is well known because it is easy to implement. The Vigenere algorithm is a development method from the Caesar Ciphertext algorithm because every character in plaintext has the same number of shifts, but in the Vigenere cipher algorithm, each character is shifted by a different number of shifts than other algorithms.

Image 10 Vigenere Table

Ci = (Pi + Ki) mod 26 ……(1)
Ci = Character decimal value cipherteks ke-i
Pi = Character decimal value plainteks ke-i
Ki = Character decimal value key ke-i

RESULT AND DISCUSSION

There are stages in processing geographic information systems, namely inputting spatial data from criminal patterns, manipulating data from criminal patterns, managing data from criminal patterns, querying and analyzing criminal patterns and visualizing criminal patterns.

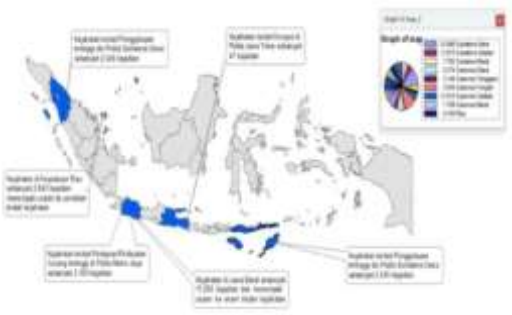

Image 6 Geographic Information System Cyber Crime pattern

There are steps used for the encryption and decryption process:

Tabel 2 XOR

A	B	A ⊕ B
0	0	0
0	1	1
1	0	1
1	1	0

Algoritma Eletronic Code Book (ECB)
Contoh plainteks B T H
Step 1 in Binary
01000010 - B
01010100 - T
01001000 - H
Step 2 is divided into blocks of 4 bits
0100 0010 0101 0100 0100 1000
Step 3 Change the letter A key to Hexa
1010
Step 3 Encryption Process
0100 0010 0101 0100 0100 1000
1010 1010 1010 1010 1010 1010 ⊕
1110 1000 1111 1110 1110 0010
Step 4 XOR Results
1110 1000 1111 1110 1110 0010
Step 5 swipe left number “1”
1101 0001 1111 1101 1100 0101
Step 6 create in binary
1101 0001 1111 1101 1100 0101
D/13 1 F D/13 C/12 5

JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. IX No 1, Desember 2022, hlm. 83 - 90 ISSN 2550-0201 (Online)
DOI: https://doi.org/10.33330/jurteksi.v9i1.1890
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

Step 7 in binary
11010001 11111101 11111101
11010001
$= (1x2^0) + (0x2^1) + (0x2^2) + (0x2^3) +$
$= (1x2^4) + (0x2^5) + (1x2^6) + (1x2^7)$
= 1 + 0 + 0 + 0 + 16 + 0 + 64 + 128
= 209
11111101
$= (1x2^0) + (0x2^1) + (0x2^2) + (0x2^3) +$
$= (1x2^4) + (0x2^5) + (1x2^6) + (1x2^7)$
= 1 + 0 + 4 + 8 + 16 +32 + 64 + 128
= 253
11111101
$= (1x2^0) + (0x2^1) + (1x2^2) + (1x2^3) +$
$= (1x2^4) + (0x2^5) + (1x2^6) + (1x2^7)$
= 1 + 0 + 4 + 0 + 0 + 0 + 64 + 128
= 197
Algoritma Vigenere
Plaintext : ELEVATION
Key : BATAMINDO
Plainteks : E = 5
Key : B = 2
Plainteks result : E + B = 5 + 2 = 7 : G
Plainteks : L = 12
Key : A = 1
Plainteks result : L + 1 = 12 + 1 = 13 : M
Plainteks : E = 5
Key : T = 20
Plainteks result : E + T = 5 + 20 = 25 : Y
Plainteks : V = 27
Key : A = 1
Plainteks result : V + A = 27 + 1 = 28 : b
Plainteks : A = 1
Key : M = 13
Plainteks result : A + M = 13 + 1 = 14 : N
Plainteks : T = 20
Key : I = 9
Plainteks result : T + I = 20 + 9 = 29 : c
Plainteks : I = 9
Key : N = 14
Plainteks result : I + N = 9 + 14 = 23 : W
Plainteks : O = 15
Key : D = 4
Plainteks result : O + D = 15 + 4 = 19 : S
Plainteks : N = 14
Key : O = 15
Plainteks results : N + O = 14 + 15 = 29 : c

CONCLUSION

Network system can be said to be safe (computationaly secure) if it meets the criteria of a mathematical equation that describes the operation of a complex cryptographic algorithm so that the algorithm is impossible to solve analytically so that by using a modification to the vigenere algorithm method it does not have a repeating password generated.

REFERENCE

[1] M. A. Kaseger, Y. D. Y. Rindengan, and A. S. M. Lumenta, "Aplikasi Pemetaan Daerah Rawan Kriminalitas Di Manadi Berbasis Web," *J. Tek. Inform.*, vol. 13, no. 2, 2018, doi: 10.35793/jti.13.2.2018.22485.

[2] R. Susanto and A. D. Andriana, "Perbandingan Model Waterfall Dan Prototyping," *Maj. Ilm. UNIKOM*, vol. 14, no. 1, pp. 41–46, 2016.

[3] Sumandri, "Studi Model Algoritma Kriptografi Klasik dan Modern," *Semin. Mat. dan Pendidik. Mat. UNY*, pp. 265–272, 2017.

[4] "QUALITY CONTROL OF OPTICAL FIBER DISRUPTION WITH BIG DATA USING THE SIX SIGMA METHOD," *STMIK R.*, vol. Vol 8, No, 2022.

[5] D. I. Sari, "Implementasi Manajemen Proyek Cpm Pada Pembangunan Infrastuktur It Optical Distribution Point," *JURTEKSI (Jurnal Teknol. dan*

Sist. Informasi), vol. VII, no. 3, 2021.

[6] F. N. Damayanti, I. N. Piarsa, and I. M. Sukarsa, "Sistem Informasi Geografis Pemetaan Persebaran Kriminalitas di Kota Denpasar," *Merpati*, vol. 4, no. 1, pp. 22–32, 2016.

[7] G. W. Sasmito, "Penerapan Metode Waterfall Pada Desain Sistem Informasi Geografis Industri Kabupaten Tegal," *J. Inform. Pengemb. IT*, vol. 2, no. 1, 2017.

[8] R. Munir, "Kriptografi," *2*, p. 645, 2019.

[9] S. Murdowo, "Mengenal Kriptografi Modern Sederhana Menggunakan Electronik Code Book (Ecb)," *Infokam*, no. 2006, pp. 29–37, 2019.

[10] A. Amrulloh and E. I. H. Ujianto, "Kriptografi Simetris Menggunakan Algoritma Vigenere Cipher," *J. CoreIT*, vol. 5, no. 2, 2019.

[11] E. Yoga Indra and Muljono, "Keamanan Pesan Teks Menggunakan Teori Chaos dan Electronic Code Book," *e-jurnal JUSITI*, vol. 4, no. 2, pp. 140–145, 2015.

[12] Suhardi, "Aplikasi Kriptografi Data Sederhana Dengan Metode Exlusive-or (Xor)," *J. Teknovasi*, vol. 03, no. 2, 2016.