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Data security using DNA cryptography

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***Abstract*—Presently a days security of information is one of the foremost critical issues; Cryptography is utilized to secure information pass through a communication channel. Within the advanced time security of put away data as well as transmitted information is exceptionally vital. Cryptography contains numerous encryption strategies like DES, RSA and so on. But they moreover hacked by aggressors. Due to this a few more capable cryptography procedures must be required. DNA Computing is one of them cryptographic procedures. It may be a modern promising field in cryptography which merged with the method of DNA computing. DNA cryptography employments DNA as a computational device in conjunction with the a few atomic procedures to control it. Due to its tremendous capacity capacity dna cryptography picks up consideration. Be that as it may this innovation is in improvement stage and requires a parcel of research. In this work we to begin with see at DNA Cryptography and its different encryption schemes. DNA cryptography may be a unused cryptographic strategy in which information is changed over into DNA utilizing DNA nucleotides.It is based on the hereditary data in which information is changed over into unreadable dna sequence.This paper proposes a procedure to supply security at client level as well as information level.At client level ,client login subtle elements are scrambled utilizing message process algorithm,MD5and the created message process is changed over into dna grouping. at information level,information is changed over into dna arrangement then generated dna arrangement is scrambled utilizing RSA calculation .this way we offer verification and secrecy to the data.This approach is exhausted python system.**

***Index Terms*—DNA,encryption,decryption**

I. INTRODUCTION

DNA computing may be a computing region wherein DNA atomic science equipment and natural chemistry are utilized to encode hereditary details in computers. In 1994,Adleman proposed DNA within the field of computation. [7] DNA Computing an be utilized to bargain with logical issues and calculations that cannot be illuminated by existing procedures of information sharing and capacity. DNA computing pick up consideration due to its speed, capacity capacity, and parallelism. DNA computing too called as natural atomic computing or atomic computing. [8]The primary objective of his strategy is to scramble the plaintext and cover up it within the DNA advanced frame. The concept of DNA computing plays an vital part within the field of computer security which is expected to be more effective and unbreakable Cryptographic calculation. [7,8,9,10]This review paper contains following sections as, section II contains background studies of DNA, section III contains DNA Computing theory section IV Why do we need DNA computing. Section V contains DNA computing as cryptography.

II. BACSIC OF DNA

Deoxyribonucleic corrosive may be a long atom that contains most of the hereditary data utilized for the development working and generation of all living being. The DNA atom contain two fundamental biopolymer strands that bend around each other to create a twofold helix. Two DNA strands are composed of nucleotides. Nucleotides are essential building piece of each DNA atom and are made up of nucleic corrosive. The particles of nucleic corrosive are exceptionally complex, holding the code that ensures the precise requesting of 20 amino corrosive. DNA is comprised of as it were four unit nucleotide and each of those nucleotide contain 3 unit:- i) sugar molecule - that are made up of five carbon sugar known as deoxyribose. ii) phosphate group- one phosphate particle is for the most part encompassed by four oxygen particles. iii) nitrogen base- are essentially the ring compounds made by nitrogen and carbon particle which is structure like a single or twofold ring. Not all the nitrogen bases can combine together to make the base combine, these are - Adenine(A), Guanine(G), Thymine(T), Cytosine(C). DNA stores all the tremendous and complex data around an life form with the combination of as it were these four letters;A, T, C and G.[7,8,9] DNA may be a grouping of these four bases and hereditary code that encoded data in an letter set. [7,8,9]DNA, twofold helix structure is combined by two free chains, which is called Watson - kink complementary twofold chain structure. A and T are interface and G and C are interface. [7,8,9]

III. DNA COMPUTING

DNA computing was colonist by Adleman in 1994.Then in 1995,R.Lipton to begin with examined the exploratory result of Adleman Leonard and deliver DNA calculation almost NP total issues. [7]Adleman utilized a brute constrain approach to unravel coordinated hamiltonian way issue utilizing DNA innovation, comprise of taking after steps: i) Produce all conceivable routes ii) select way that begin with the right city and conclusion with the ultimate city iii) select way with adjust number of cities iv) select way that contains each city as it were once In his test [7] He fathomed the occurrence of chart containing seven vertices by encoding it into atomic shape by utilizing DNA hybridization technique

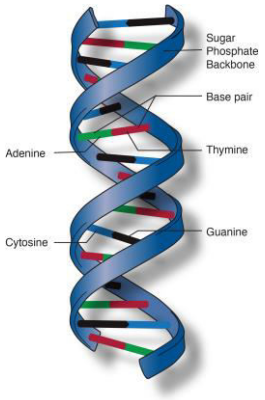

Fig. 1. An image of DNA

and the computational operations were performed with the assistance of standard proteins called Polymerase which duplicate a segment of single standard DNA beginning at the position of a groundwork.He utilized a method called Gel Electrophosis, which is utilized for sorting DNA by length and select the DNA whose length compares to seven cities. But it has two brief comings that are, in case number of cities are expanded at that point the desired DNA would be absolutely inconceivable. Other is blunder rate as the operations are not deterministic in nature. Afterward in 1995,lipton expanded the work of Adleman by understanding another NP total issue called fulfillment by utilizing DNA atom in a test tube to encode the chart for 2 bit numbers. In 1996,Dan Boneh et a connected the approches of DNA Computing utilized by Adleman and Lipton in arrange to break one of the symmetric key calculation utilized for Cryptographic purposes known as DES. They performed organic operations on the DNA strands in a test tube,such as extraction, polymerization by means of DNA polymerase, enhancement through PCR and perform operation on the DNA strands which have the encoding of twofold strings. [5]

A. Why do we need DNA Computing

DNA Computing can be utilized to bargain with logical issue and calculations that cannot be effectively fathomed by utilizing existing strategy of information sharing and capacity. DNA Computing got to be highlighted due to its speed which is 100 times quicker ;negligible control prerequisite ; negligible capacity prerequisite as 1 gram of DNA can store 700 TetraByte. [31] Not as it were this, there are a few impediments with Conventional computing. These are as takes after:

1) Miniaturization restrain in which it is being said that there's a restrain for silicon chip that how distant it's Miniaturization hit by Heisenberg vulnerability principle(HUP) which states that the act of watching these component influence their conduct. Due to this it got to be impossible to know the precise state of component without on a very basic level changing its state.
2) Von Neumann bottleneck, typically forced by the require for the CPU to transfer instruction and information to and from the most memory by successive rationale. But DNA computing denies the miniaturization held the parallel preparing which gave it the solid point for creating at this level. [31]

B. Cryptography

Cryptography can be characterized as the science that secure information with the assistance of encoding plaintext into garbled arrange. This garbled content is called cipher content. The strategy of encoding plaintext into cipher content is called encryption and changing over cipher content into plain content is called decryption. This strategy is additionally called as cryptanalysis. Cryptology is characterized as the combination of cryptography and cryptanalysis. Data security administrations given by cryptography are privacy, information judgment, verification and non- disavowal. The cryptographic primitives which give data security as well as cyber security are scramble, hash work, message confirmation code(MAC) and advanced signature. Another angle of cryptography is steganography. It is the hone which not as it were conceals the substance of mystery message but too the truth that the message is being transmitted. There are two sorts of cryptosystems:

1) Symmetric key encryption-same key is utilized for encryption and decoding. Security benefit given by this strategy is secrecy. DES, Triple DES, Blowfish and IDEA are case for symmetric key encryption.
2) Asymmetric key encryption - different keys are used for encryption and decryption. RSA, Diffie-Hellman, Elliptic curve cryptography are exampleof asymmetric key encryption. [2][1][3]. DNA cryptography : DNA cryptography is a new born cryptography in which DNA is used for encrypt and decrypt the data. It is in researching field.

C. DNA based Cryptographic Techniques

DNA cryptography could be a modern born cryptography ,in which data is carried in DNA ,the atomic innovation is investigated for cryptographic purposes such as encryption ,signature and so on. There are a few cryptographic procedures utilized DNA ; DNA complement operation,DNA computerized coding,Polymerase chain Response ,DNA chip based,Elliptic Bend cryptography utilizing DNA Encoding,DNA steganography,DNA Fragmentation.

1) DNA complement Operation:Four neucleotide bases Adenine(A),Guanine(G),Thymine(T),Cytosine(C) are connected according to the Watson Crick Complementory rule, as, A is connected with T and G is connected with C.for example , DNA sequence GCTACGCTAGTA is complemented as,CGATGCGATCAT.

2) DNA digital coding:This technique maps the nuecleotide bases A,G,C and T with 0 and 1. Plain Text message can be easily encoded with this techniques.

conversion of binary into nucleotides

Binary Form	Nucleotide
00	A
01	T
10	G
11	C

TABLE I
2 BIT DNA TO BINARY CONVERSION

DNA	Binary
CG	0000
AG	0001
AC	0010
AT	0011
GT	0100
AA	0101
TA	0110
TG	0111
GG	1000
TC	1001
GA	1010
CT	1011
GC	1100
CC	1101
CA	1110
TT	1111

IV. LITERATURE REVIEW

[15]maker had executed security of information utilizing RSA and OTP key period that are getting utilized for encryption and unscrambling of plain substance, picture , sound ,video that are changed over from twofold to DNA gathering. RSA is suitable for the twofold layer security. MAC Address is extraordinary recognizing verification which makes a contrast to relate one or more center points and from which the information is transmitted from one center to another center in secured way . OTP is send to receiever while sending message.In[16],author had executed the data based security procedure utilizing AES calculation. This strategy deliver a multilayer security. The DNA based key is utilized for encryption and unscrambling process.first the message is changed over into ascii these ascii numbers are assembled into square apply 4 [twofold digit] planning rule to change over the data in a progressed course of action of DNA.The mixed course of action of twofold is portion into 2 bit DNA progressed coding.apply DNA taken care of AES encryption calculation .Encryption is smple than unscrambling it suggests the translating get ready will take longer time as well as complex.In[17], a twofold frame of information, such as plaintext messages, or pictures are changed into groupings of DNA nucleotides. At that point, these nucleotides exchanged into amino corrosive and their condon representation in frame of DNA , at that point pass through a Four square encryption prepare based on amino-acids structure. The equivocalness is additionally implanted to it.In[18], creator creates a DNA based key for client confirmation key to induce section or information get to consent in cloud at that point irregular key era is utilized for encryption. To begin with ,message is changed over into ASCII , at that point each ASCII esteem is changed over into twofold ,at that point utilizing the 2 bit twofold DNA coding parallel arrangement is changed over into DNA grouping at that point utilizing arbitrary key era table DNA arrangement is changed over into Last cipher content. By this creator gives security to the client level.In[19],a information covering up half breed procedure is presented utilizing the concept of cryptography and steganography to attain triple layer of security in cloud.The proposed strategy comprise of three stages of encryption :stage 1 changing over the message into dna arrange taken after by applying playfair cipher based on dna and amino corrosive to scramble the mystery message which produce ambiguity.phase2 is covering up the cipher mystery message portion with the equivocalness comes about from the primary phase.phase three is stowing away the comparing twofold of yield gotten in stage two utilizing picture steganography.In[20],proposes a method for DNA cryptography based on energetic component i.e. energetic grouping table and energetic DNA encoding.the plaintext is changed over into ASCII esteem at that point into parallel at that point into DNA bases at that point once more create ASCII esteem utilizing DNA arrangement table. partition it into a limited number of settled chunks.then scramble each chunk utilizing an deviated cryptosystem.transform ciphertext of each chunk into DNA bases. consolidate each two touching chunks utilizing DNA encoding.In[21],Upgraded twofold layer security utilizing RSA over DNA based Information Encryption System,author performs 3 stages to supply security to information, at to begin with information is changed into DNA and amino corrosive cipher content in stage two this cipher content is hided utilizing reference dna by inclusion technique,in third stage the cipher content is scrambled utilizing the key created in phase1 utilizing RSA calculation.[22],The most objective of this calculation is to guaranteeing three fundamental objectives of security, privacy, judgment and accessibility and secure the key of playfair lattice cipher procedure (symmetric key cryptography) and give the secure channel to send the key of Playfair cipher to the receiver conclusion with the assistance of RSA calculation (topsy-turvy key cryptography), assaults conceivable on data and handle them with right sorts of counter measures and see at the various variations proposed by diverse creators and after that to come up with a unused altered cipher which is able be more grounded than the conventional Playfair cipher. [23]In this paper, creator endeavor to create a quick cross breed cryptosystem based on Elliptic Bend and DNA computing for giving security benefit. The security of the proposed plot is based on Elliptic Curve Discrete Logarithm Issue (ECDLP). The most objective of this development is to upgrade the security of elliptic curve cryptosystem utilizing DNA Computing. In this approach information put away on the cloud server within the scrambled frame and indeed on the off chance that information is gotten to by the aggressor, the assailant can't get the current information.

In this paper, a quick crossover calculation based on EC ElGamal cryptosystem and code computing is proposed. The Quality of the calculation due to the trouble level utilized in computing discrete logarithm and code computing based DNA encoding. Moreover Integration of Elliptic bend cryptosystem and code computing has progressed the security level given to the user's information within the Cloud. From the tests, it is demonstrated that the framework is exceedingly secure and difficult to perform a cryptanalysis assaults. Essentially, the proposed approach gives information secrecy for the information exchanged between the Information Proprietor and the Information Client in a cloud environment.[24]A unused DNA sequence-based data-hiding plot is displayed in this paper. Creator set up an injective mapping between one complementary run the show and two mystery bits in a message. Based on this mapping instrument, the proposed plot can effectively hide two mystery bits in a message by supplanting one character. This approach can greatly improve the implanting capacity in information covering up. Vigor and security examinations show that the likelihood of an attacker's making a effective recuperation of the covered up information is negligible. Agreeing to the exploratory comes about, the proposed conspire contains a steady and efficient inserting capacity with a moo modification rate, and the fake DNA sequence does not got to grow the length of the reference DNA grouping.[25]In this paper, creator propose a novel algorithm to communicate information safely. The proposed technique is a composition of both encryption and information hiding using a few properties of Deoxyribonucleic Corrosive (DNA) sequences. Consequently, the proposed plot comprises mainly of two stages. Within the to begin with stage, the secret data is scrambled employing a DNA and Amino Acids-Based Playfair cipher. Whereas within the moment stage the encrypted data is steganographically covered up into a few reference DNA grouping utilizing an inclusion procedure. The proposed calculation can effectively work on any binary data since it is really changed into a sequence of DNA nucleotides utilizing a few twofold transformation rule. Subsequently, these nucleotides are spoken to as an amino acids structure in arrange to pass through the uncommonly planned Playfair Cipher and scramble it into another DNA arrangement. At that point, this scrambled DNA information is haphazardly embedded into a few reference DNA sequenceto create a faked DNA arrangement with the scramble data hidden. In arrange to recoup the inserted mystery information, the collector can carry out the converse prepare with the assistance of the both the mystery key and the reference DNA grouping.[26]Author proposes a method and usage of a modern DNA - Based stream cipher algorithm.The primary reason of this calculation is to utilize one of the 1.6 × 108 genuine DNA arrangements that are accessible within the online database (NCBI database) as a reasonable genuine arbitrary DNA grouping (i.e., a reference grouping) to generate genuine arbitrary keys with distinctive lengths and distinctive information to overcome the issues of key lengths in a few calculations. By utilizing the four bases of DNA (A¡ C, G, T), we produce dynamic DNA tables to supplant message characters by a energetic DNA sequence. The proposed procedure is additionally based on employing a moment arrange chaotic condition to create pseudo random groupings which are utilized for distinctive purposes such as: producing one-time cushion (OTP) keys, changing the message piece lengths, creating energetic coding tables for the ASCII characters of the message. The OTP key is XOR-ed with the message square. At that point, the result is changed over to a DNA arrangement. At last, we apply steganography concept by stowing away the come about cipher content in a haphazardly chosen record from the utilized database. The gotten cipher content contains the data that will give improved security against the gatecrasher assault.[27] In this paper creator have proposed a modern strategy of picture steganography i.e. Hash-LSB with RSA calculation for giving more security to information as well as our information stowing away strategy. The proposed procedure employments a hash work to create a design for covering up information bits into LSB of RGB pixel values of the cover picture. This procedure makes beyond any doubt that the message has been scrambled some time recently covering up it into a cover picture. In case in any case the cipher content got uncovered from the cover picture, the halfway individual other than recipient can't get to the message because it is in scrambled frame.[28]Cryptography is one the major components in information security and communications security .DNA Cryptography may be a unused field in cryptography which saddles rise of DNA computing to supply tall level of information encryption. In any case, DNA cryptography isn't utilized in standard computing due to the computational complexity and necessity of a bio atomic research facility. This paper proposes a unused scheme for DNA cryptography employing a combination of Hybridization of DNA oligonucleotides and the bland twofold one time cushion strategy.[29] his paper bargains with a unused arrangement approach to overcome the inadequacies of the Playfair calculation. In this paper, the displayed PlayfairCBC encryption component makes the cryptanalysis complex. The scrambled content gotten is nearly garbled. The proposed PlayfairCBC calculation is actualized and number of tests is performed to demonstrate its productivity. At last, it has been analyzed on the basis of avalanche effect.

V. Methodology and Proposed Technique

A. Message digest Algorithm

Message Digest is utilized to guarantee the astuteness of a message transmitted over an unreliable channel (where the substance of the message can be changed). The message is passed through a Cryptographic hash work. This work makes a compressed picture of the message called ProcessDigest.[32] This message and process combine is identical to a physical record and unique finger impression of a individual on that archive. Not at all like the physical archive and the unique finger impression, the message and the process can be sent independently. Most critically, the process ought to be unaltered amid the transmission.

The cryptographic hash work may be a one way work, that's , a

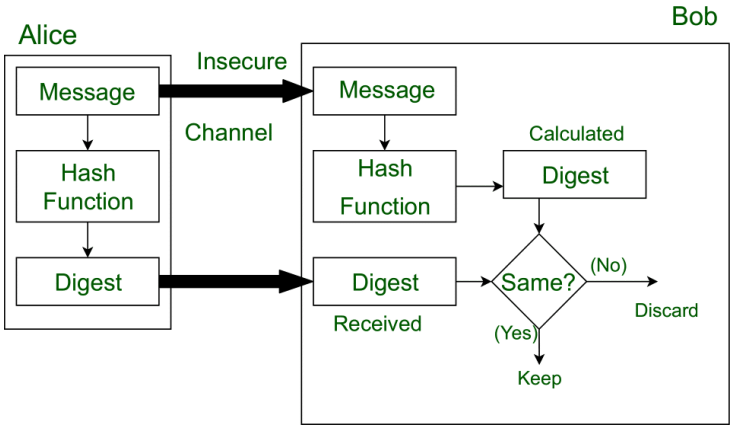

Fig. 2. MD5 algorithm

work which is essentially infeasible to alter. This cryptographic hash work takes a message of variable length as input and makes a process / hash / unique mark of settled length, which is utilized to confirm the astuteness of the message. Message process guarantees the keenness of the archive. To supply realness of the message, process is scrambled with sender's private key.[32]

B. RSA algorithm

RSA calculation is deviated cryptography algorithm.The thought of RSA is based on the reality that it is troublesome to factorize a expansive numbers. The open key comprises of two numbers where one number is increase of two expansive prime numbers. And private key is additionally determined from the same two prime numbers. So on the off chance that some person can factorize the expansive number, the private key is compromised. Therefore encryption quality completely lies on the key estimate and in the event that we twofold or triple the key estimate, the quality of encryption increments exponentially. RSA keys can be regularly 1024 or 2048 bits long, but specialists accept that 1024 bit keys may be broken within the close future. But till presently it appears to be an infeasible assignment.[32]

C. DNA Encoding Algorithm:

client data or information isn't clearly changed over into dna course of action. to start with the data is changed over into twofold shape at that point these twofold outline are changed over into dna sequence.these dna nucleotiodes A,G,T and C are changed over into twofold . to begin with two bit twofold are utilized to change over into dna course of activity businesses table2.At that point two bit DNA course of activity is changed over into four bit twofold to supply more security.

VI. PROPOSED SYSTEM

The proposed system works on two unmistakable level. at to start with level,user capabilities are encrypted.this works

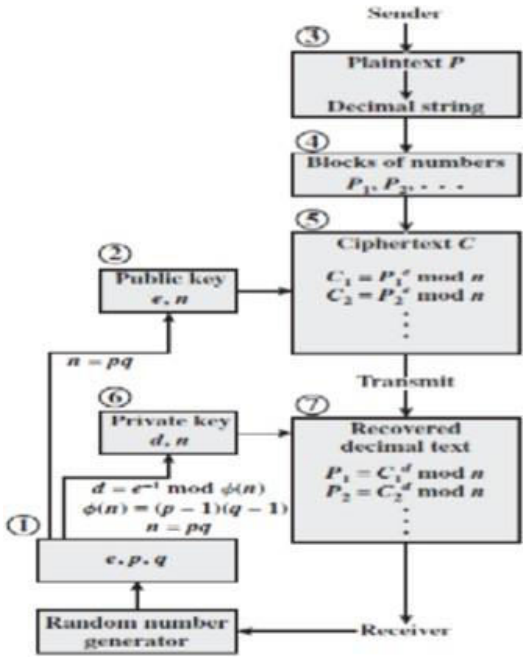

Fig. 3. rsa algorithm.

on two particular phase.at arrange one,user login focuses of intrigued are changed over into hash prepare utilizing message handle algorithm,md5.at arrange two, created hash handle from arrange one is changed over into dna gathering utilizing dna encoding rule.this donate security to the client information.At level two,DNACA(dna cryptographic calculation) is utilized for encryption and unscrambling. this calculation works on two phases,at organize one, data is changed over into ASCII values,then into twofold gathering this parallel gathering is changed over into dna sequence,is changed over into 4 -bit twofold coding. twofold gathering is created. this gathering is changed over into decimal regard. at organize two, this decimal regard is utilized as plaintext for encryption utilizing RSA. RSA is associated to plain substance ,utilizing open key this plain substance is changed over into cipher text.this cipher substance is help changed over into dna sequence.this is the extreme surrender.

A. Proposed Technique

The client level security is given by utilizing MD5,later the created message handle is mixed into DNA orchestrate .from this affirmation is given .at that point for data ,the primary message is changed over into DNA outline by utilizing DNA encoding run the appear. at that point the created gathering is changed over into twofold outline utilizing 4 bit parallel combination table. the made twofold gathering is changed over into decimal outline .RSA businesses this decimal regard as plaintext. open key scramble this decimal regard.

from here, cipher substance is created .this delivered cipher substance is energize changed over into dna course of action. The foremost objective is to supply security from ambushes that are conceivable in the midst of client enrollment as well on data encryption. Existing ask around works have been proposed distinctive cryptographic methodologies, calculations and techniques with dna for favoring the client for getting to data. DNACA (DNA cryptography calculation) is utilized for data security. DNA is utilized to alter over the client information and data information.
In this investigate work,we employments two diverse cryptographic methods with dna at two distinctive level.

B. User encryption phase

Encryption process for user registration is explained as follows:

1 Enter user name and password.
2 username and password is converted into hash digest using md5.
3 this hash digest is converted into dna sequence
4 dna sequence is stored into database.

C. Data Encryption Phase :

1 Message is converted into ASCII value.
2 ASCII values are converted into binary sequence.
3 Binary sequence is converted into dna sequence using dna encoding rule.
4 Generated dna sequence is converted into binary sequence using 4 bit binary combination table.
5 Binary sequence is converted into decimal value.
6 Select two large prime numbers p and q.
7 Calculate value of N.
8 Calculate public key ,e.
9 Calculate private key,d.
10 Use decimal value generated from phase I for encryption.
11 Cipher text is generated.
12 Cipher text is converted into dna sequence.

VII. RESULTS

A. Attack analysis

1 Brute force attack:in which assailant applies all the conceivable combinations to discover the first value.in this paper,the proposed method overcome this attack.as the client watchword as well as information both are scrambled in dna .conceivable combinations are depend on the length of dna .so it gotten to be complex and more time taken.
2 password based attack: secret word is put away in dna form.so when client is confirmed paswword is coordinated with the dna put away in database.
3 Ciphertext attack:in the event that the assailant tries to discover out the cipher content it get the dna sequence.possibility of combination is rise to to factorial of the length of dna. for case in the event that dna grouping is AGTCCCGCTA,thelength of arrangement is 10,it implies 10! which is equa lto 8,628,800.and each time in the event that he change over into content arrange he get distinctive values so it becme complex to discover unique esteem.
4 Plaintext attack: plaintext is in decimal frame so guesss the initial content he does not know what is the real content for decimal shape.
5 Factorization attack:to avoid factorization attack,large prime numbers are chosen.

B. Result

The proposed DNA cryptographic calculation is executed in python tongue of Pycharm program over Windows-10. the calculation is considered as topsy-turvy key calculation as open key is utilized for encryption and private key is utilized for decryption.in this proposed procedure md5 is utilized with dna bases to supply security for confirmation. As md5 make a hash regard these hash regard are help changed over into dna sequence.this created dna course of action is put absent in database. though client login with their watchword ,mystery word is changed over into dna course of action ,the made dna gathering is checked with the put absent dna in database whether it is facilitated or not. this overcome the attack inspected over .at that point data is mixed utilizing dna encoding rule.then dna course of action is changed over into twofold gathering which is development changed over into decimal regard. rsa calculation is associated on this decimal value.public key scramble it into cipher substance, this cipher substance is changed over into DNA Strand so that assailant cannot figure what the honest to goodness message or information. The time complexity as compared with the existing unpredictable number delivered dna base key calculation ,it is illustrated that proposed strategy takes less time in confirmation as well as in data encryption .

VIII. CONCLUSION AND FUTURE WORK

A. Conclusion

Secret word security is one of the foremost imperative perspective of information security as most framework presently a days require an verification strategy utilizing passwords. hashing calculation such as MD5 are commonly utilized for scrambling plaintext secret word into string that that theoritecally cannot be decided by programmers due to their one way encryption feature.with time assault can be conceivable through the utilize of lexicon tables dictionary tables.
the proposed work employments a cross breed plot of DNA prepare and rsa calculation which features a great comes about within the time analysis.thus the calculation is demonstrated to be cryptographically secure and it is appropriate for application where more than one layer of security is required. this DNA layer which surrounds the RSA layer includes disarray to the information so that it'll be troublesome for

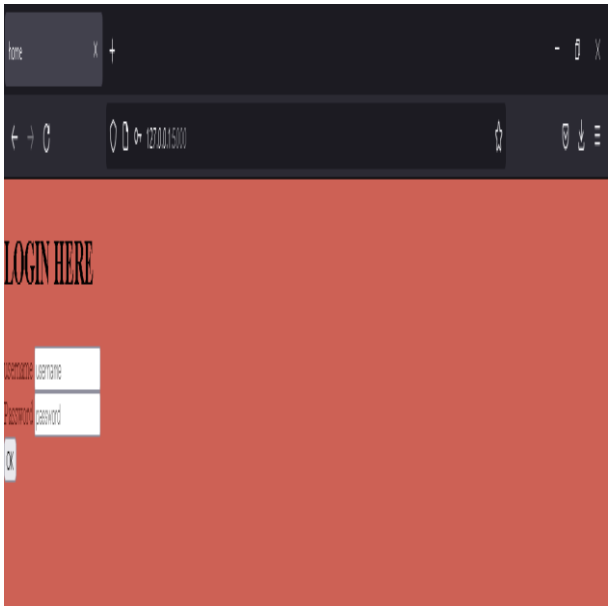

Fig. 4. Login Screen.

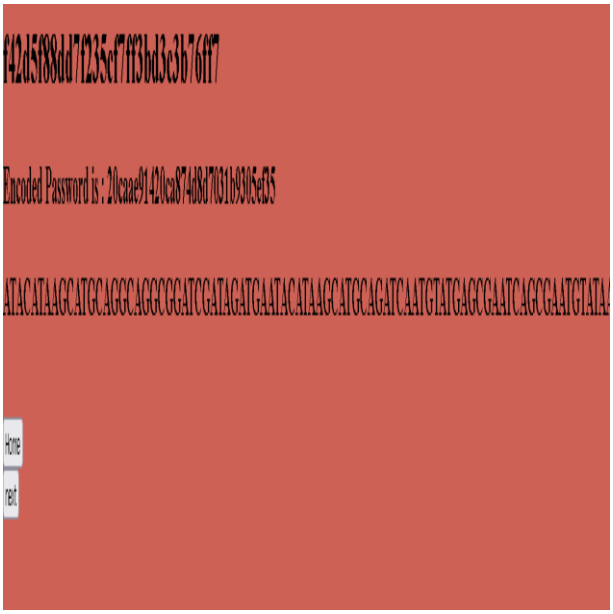

Fig. 6. Values are encoded into hash value using MD5.

Fig. 5. Cedentials entered.

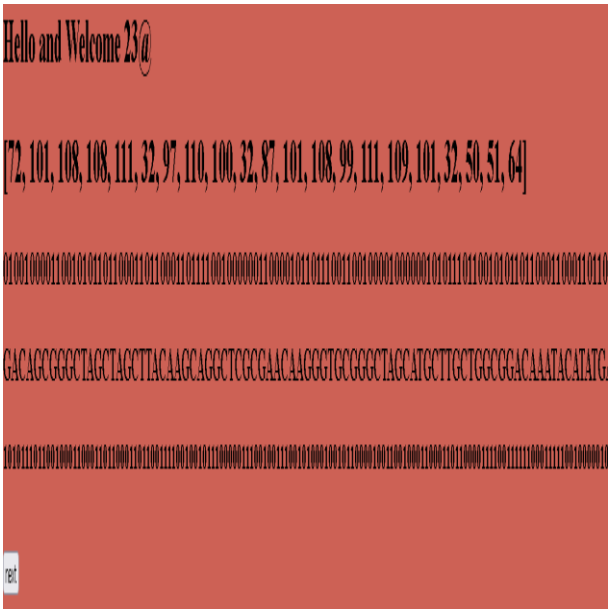

Fig. 7. Message .

interloper to decode the message.in future, this calculation can be improved further by including more dna prepare such as changing over dna arrangement to amino corrosive which is able include to the security of the framework.

The most objective of this inquire about work is to plan and actualize a novel security calculation for fixing the user level as well as data-level security. The comes about are compared with the existing approach comes about and demonstrated that the proposed DNA is superior than the other cryptographic approach in terms of time complexity. at the another level information is changed over into dna grouping the assist this dna arrangement is changed over into decimal arrange and RSA is connected. this makes disarray for the programmer in decoding information and information is safely decoded by reciever.

B. Future work

As DNA cryptography is continuous inquire about field, since of capacity information can be put away in TB. one gram of DNA can put away 700 TB.traditional cryptography calculation is utilized with DNA to supply tall security this changes over the information into dna arrangements which are

Fig. 8. message converted in python framework.

Fig. 9. DNA sequence converted into Decimal format.

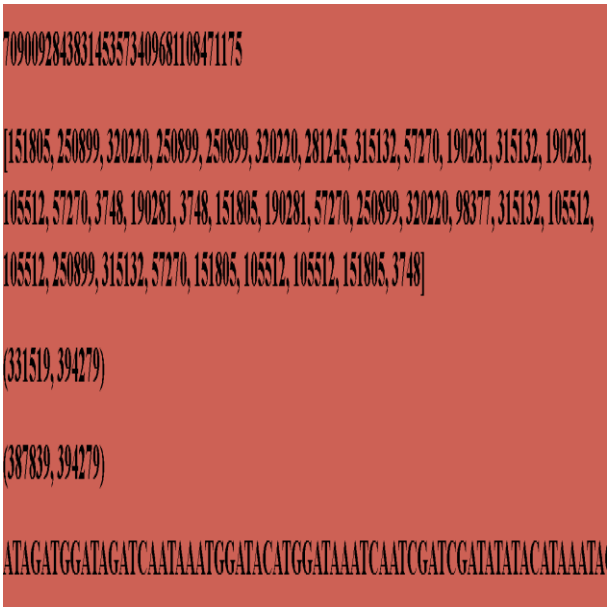

Fig. 10. Decimal value is encrypted into dna sequence using RSA and DNA encoding table.

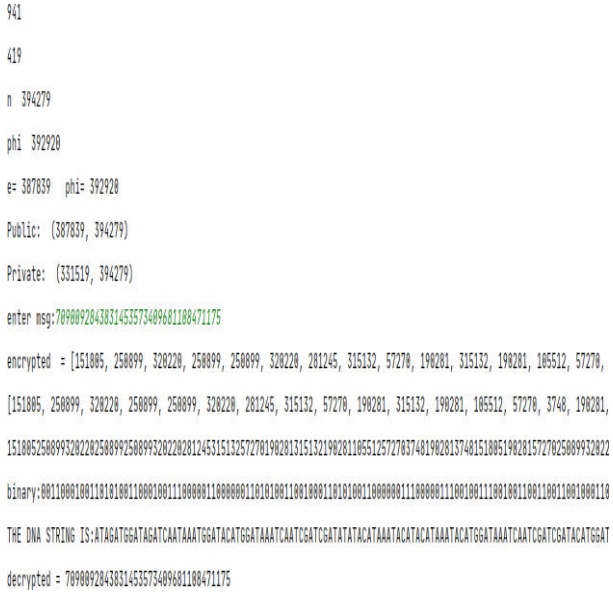

Fig. 11. values in python framework.

not effectively recognizable for atacker.To give more pertinent security this dna grouping is mapped with picture utilizing steganography and put away the information on cloud. As information to begin with changed over into dna grouping utilizing dna cryptography at that point put away into the picture organize utilizing steganography at that point put away this picture on cloud. this three stage encryption makes information more secure.

IX. REFERENCES

1) Pramendra Kumar ,Vijay Kumar Sharma,Information Security Based on Steganography and Cryptography Techniques: A Review International Journal of Advanced Research in Computer Science and Software Engineering Research Paper.
2) Dr. Sandeep Tayal1 , Dr. Nipin Gupta , Dr. Pankaj Gupta, Deepak Goyal, Monika Goyal, A Review paper on Network Security and Cryptography, Advances in Computational Sciences and Technology ISSN 0973-6107 Volume 10, Number 5 (2017) pp. 763-770 .
3) Muharrem Tuncay Gençoğlu Importance of Cryptography in Information Security , IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661,p-ISSN:

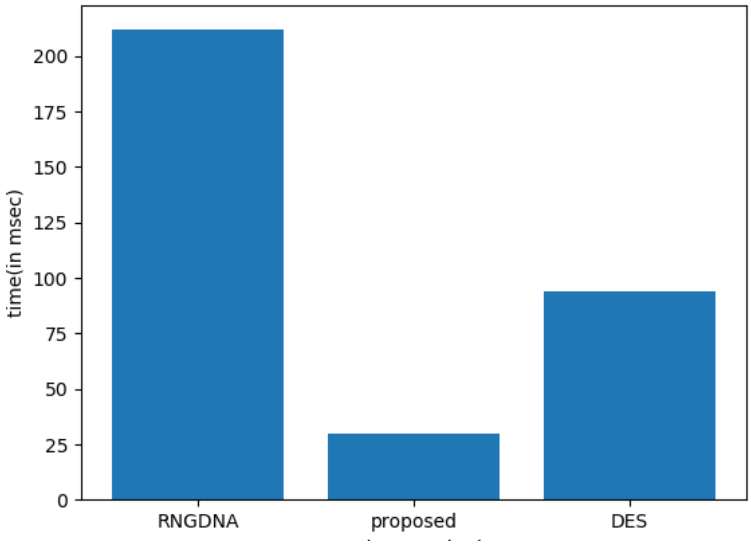

Fig. 12. graph representation.

2278-8727, Volume 21, Issue 1, Ser. II (Jan - Feb 2019), PP 65-68

4) Abdalbasit Mohammed Qadir, Nurhayat Varol,A review paper on cryptography, 978-1-7281-2827-6/19.
5) A.E. El-Moursy, Mohammed Elmogy, Ahmad Atwan," DNA-based cryptography: motivation, progress, challenges, and future", JOURNAL OF SOFTWARE ENGINEERING and INTELLIGENT SYSTEMS ISSN 2518-8739 30 th April 2018, Volume 3, Issue 1, JSEIS, CAOMEI Copyright © 2016-2018
6) ANUPRIYA AGGARWAL1 PRAVEEN KANTH2," DNA ENCRYPTION", International Journal of Computer Science and Engineering (IJCSE) ISSN(P): 2278-9960; ISSN(E): 2278-9979 Vol. 3, Issue 3, May 2014, 51- 66
7) Samir Abou El-Seoud Reham Mohamed Samy Ghoneimy," DNA Computing: Challenges and Application",
8) Mohit1 , Manisha2 , Parvinder Bangar" A Survey on DNA Based Cryptography", International Journal for Research in Applied Science and Engineering Technology (IJRASET) Volume 3 Issue III, March 2015 ISSN: 2321-9653
9) Gambhir Singh, Rakesh Kumar Yadav," DNA Based Cryptography Techniques with Applications and Limitations ", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-8 Issue-6, August 2019
10) XIAO Guozhen1 , LU Mingxin1 , QIN Lei2 LAI Xuejia3," New field of cryptography: DNA cryptography ", Chinese Science Bulletin 2006 Vol. 51 No. 12 1413—1420
11) MANDRITA MONDAL, KUMAR S. RAY ," Review on DNA Cryptography"
12) Beenish Anam, Kazi Sakib ,, Md. Alamgir Hossain,k eshav Dahal," Review on the Advancements of DNA Cryptography"
13) Nikita Parab1, Ashwin Nirantar2," Survey of different DNA Cryptography based algorithms " International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 12 — Dec-2017
14) Baraa Tareq Hammad1 , Ali Maki Sagheer2 , Ismail Taha Ahmed3 , Norziana Jamil4," A comparative review on symmetric and asymmetric DNA-based cryptography" Bulletin of Electrical Engineering and Informatics Vol. 9, No. 6, December 2020, pp. 2484 2491 ISSN: 2302-9285, DOI: 10.11591/eei.v9i6.2470
15) A dynamic DNA Cryptography using RSA and OTP
16) An information security using DNA cryptography along with AES Algorithm
17) Sonal Namdev*, Vimal Gupta** A DNA and amino acid based implementation of four square cipher, ISSN: 2248-9622, Vol. 6, Issue 1, (Part – 2) January 2016, pp.90-96
18) Prasanna Balaji Narasingapuram, M. PonnavaikkoDNA cryptography based user level security for cloud computing and applicationInternational Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue-5, January 2020
19) Dhanya M S,Asha joe,DincyE,DNA based Cryptography and steganography in cloud computing using socket programming,International journal for research in applied science
20) Meettu Skariya ,,Mariam Varghese, Enhanced double layer security using RSA over DNA based Data Encryption system,International Journal of Computer Science Engineering Technology (IJCSET)
21) Dr. Sunil Gupta, Pawan Tiwari, Dr. Deepak Choudhary,A Novel Approach to Security using Extended Asymmetric Based RSA Algorithm,international Journal of Innovative Research in Technology and Management (IJIRTM), Volume-3, Issue-1, 2019. ISSN: 2581-3404
22) Md. Rafiul Biswas , Kazi Md. Rokibul Alam, Shinsuke Tamura, Yasuhiko Morimoto,A technique for DNA cryptography based on dynamic mechanisms,Journal of Information Security and Applications. Hafidi, Fatima Amounas, Lahcen El Bermi, Moha Hajar, Fast hybrid cryptosystem for enhancing cloud data security using Elliptic curve cryptography and DNA computing
23) C Guo, CC Chang, ZH Wang - Int. J. Innov. Comput. Inf. Control, 2012 - ijicic.org, A new data hiding scheme based on DNA sequence
24) A. Atito ·A. Khalifa ·S. Z. Rida, DNA -based data encryption and hiding using playfair and insertion technique
25) Design and Implementation of a New DNA Based Stream Cipher Algorithm using Python
26) A secure image steganography based on RSA algorithm and Hash-LSB technique
27) DNA cryptography based on DNA hybridization and one time pad scheme
28) Implementation of Modified playfair CBC algorithm

29) Implementation of DNA Cryptography in cloud aomputing and using socket programming
30) Enhanced Data storage security DNA cryptography in cloud
31) Advances of DNA Computing in cryptography by, Suyel Namasudra,Ganesh Chandra Deka,CRC Press Taylor and Francis group
32) Cryptography and network Security:principle and practice by William stallings
33) Auquib Hamid Lone,prof. Moin Uddin; Common attacks on RSA and its variants with possibile countermeasures
34) Mary CindyAh kioon,ZhaoShun Wang And Shubra DebDas,Security analysis of MD5 algorithm in password storage,International Symposium on Computer ,Communication,control and automation(ISCCCA-13)