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CONTENTS

Sr. No.	TITLE & NAME OF THE AUTHOR (S)	Page No.
1.	LAGUNA INDUSTRIES' CORPORATE SOCIAL RESPONSIBILITY (CSR) PROGRAMS: LAGUNA INTERNATIONAL INDUSTRIAL PARK, PHILIPPINES <i>DR. ANTONIO D. YANGO, DR. PEDRITO JOSE V. BERMUDO, DR. NONET AMA CUY, DR. MA. LINDIE D. MASALINTO & DR. LEONOR N. TIU</i>	1
2.	MAPPING THE INTELLECTUAL STRUCTURE OF HUMAN RESOURCES <i>CHIN-HSIU TAI, CHE-WEI LEE & YUAN-DUEN LEE</i>	9
3.	ROLE OF COMPETENCE DEVELOPMENT FOR ENHANCEMENT OF TECHNICAL SKILL WITH SPECIFIC REFERENCE TO BHILAI STEEL PLANT <i>JAI PRAKASH PANDEY & SANJAY GUHA</i>	14
4.	EFFECTIVE SUPPLY CHAIN MANAGEMENT THROUGH SAP <i>KURUGANTY SEETHA RAM BABU & A. V. SATYANARAYANA RAO</i>	17
5.	CONVERSATION OF INNOVATION IN BUSINESS: INDIAN INDUSTRY CASE STUDY <i>DR. SURESH TULSHIRAM SALUNKE & SHWETA SURESH TULSHIRAM SALUNKE</i>	23
6.	CRYPTOGRAPHY: THE ESSENTIAL PART OF MODERN ERA <i>CHARU JAIN</i>	26
7.	EMPLOYEE PRODUCTIVITY MANAGEMENT SYSTEM ADOPTED BY THE HOSPITALITY INDUSTRY IN INDIA <i>MILIND A. PESHAVE & DR. RAJASHREE GUJARATHI</i>	29
8.	AN EMPIRICAL STUDY ON AWARENESS LEVELS OF CORPORATE SOCIAL RESPONSIBILITY WITH A SPECIAL REFERENCE TO FORD FOUNDATION <i>V.PRATHIBA & DR. S. V. RAMANA</i>	38
9.	AN EMPIRICAL STUDY ON WEAK-FORM OF MARKET EFFICIENCY OF BSE BANKEX STOCKS <i>ASHA NADIG & DR. B. SHIVARAJ</i>	43
10.	A SURVEY ON AUTOMATIC QUESTION-ANSWERING TECHNIQUES <i>M. MAMATHA, D.KAVITHA & T.SWATHI</i>	47
11.	MICRO SMALL & MEDIUM ENTERPRISES COMPETING IN GLOBAL BUSINESS ENVIRONMENT: A CASE OF INDIA <i>DR. D.LALITHA RANI & K.SANKARA RAO</i>	50
12.	A STUDY ON CUSTOMER RELATIONSHIP MANAGEMENT (CRM) THROUGH E-BANKING <i>DR. BADIUDDIN AHMED & RIAZUDDIN AHMED</i>	56
13.	FINANCIAL LEVERAGE AND ITS IMPACT ON STOCK RETURN <i>DR. KUSHALAPPA. S, VIJENDRA SHENOY. H & DR. P. PAKKEERAPPA</i>	59
14.	WEB SESSION CLASSES: PERFORMANCE METRICS FOR BUSINESS LOGIC ISSUES IN N-TIER AND MVC ARCHITECTURE <i>ASHOK KUMAR, MANISHA JAILIA & MANISHA GARHWAL</i>	67
15.	THE STUDY OF PROBLEMS FACED BY COMMERCE STREAM STUDENTS OPTING FOR COMPUTER EDUCATION <i>PRATIBHA GUPTA & RISHI RAJ BALWARIA</i>	74
16.	AN EVALUATION OF ETHICS IN INSURANCE SECTOR <i>DR. BADIUDDIN AHMED, SYED HAMID MOHIUDDIN QUADRI & MOHAMMED ABDUL LATEEF</i>	81
17.	COMPARATIVE STUDY OF ADVERTISING MEDIA EFFECTIVENESS IN NAVSARI CITY <i>ZAKIRHUSEN PATEL & MIHIR SONI</i>	85
18.	DHARMA ENSURING WELFARE & TRANSPARENCY IN CORPORATE GOVERNANCE <i>GEETU SHARMA</i>	90
19.	A STUDY ON VALUE GENERATION IN LEVERAGED BUTOUT'S <i>SURESH A.S</i>	94
20.	DOES THE OWNERSHIP MAKE A DIFFERENCE IN PERFORMANCE?: AN ASSESSMENT ON PUBLIC AND PRIVATE INSURERS IN INDIA <i>SANGEETHA R</i>	97
21.	REASSESS OF CAPITAL STRUCTURE THEORIES <i>RAJIB DATTA, TASNIM UDDIN CHOWDHURY & HARADHAN KUMAR MOHAJAN</i>	102
22.	A STUDY OF ICT APPLICATION IN THE LIBRARIES AT THE TERTIAL LEVEL IN SIKKIM <i>NEERAJ KUMAR & AJAY KUMAR PANDEY</i>	107
23.	THE INTERPLAY OF ORGANIZATIONAL DYNAMICS ON CORPORATE GOVERNANCE IN THE FACE OF A PERFORMANCE CONTRACTING IN KENYA <i>PRISCA BITTOK & DR. OTIENO MOSES</i>	110
24.	WHAT DOES SUSTAINABLE DEVELOPMENT REALLY MEANS? - A STUDY ON DIFFERENT DIMENSIONS OF SUSTAINABILITY <i>BASHEER. M</i>	114
25.	GREEN AUDIT: NEXT GENERATION'S HOPE <i>DR. S. K. JHA</i>	117
26.	AN ANALYTICAL STUDY FOR FINANCIAL MANAGEMENT OF FLAT GLASS INDUSTRIES IN INDIA <i>SHAILENDRA SAXENA</i>	122
27.	SECURITY ISSUES IN DBMS <i>GEETIKA</i>	129
28.	A STUDY OF MOTIVATIONAL FACTORS FOR THE EMPLOYEES OF A POULTRY INDUSTRY <i>SHANKAR K. JHA</i>	131
29.	AN ANALYSIS OF WORKING CAPITAL MANAGEMENT EFFICIENCY IN INDIAN TEXTILE INDUSTRY <i>OMID SHARIFI</i>	135
30.	AN ANALYSIS OF INCOME AND EXPENDITURES OF TAMIL NADU BASED PRIVATE SECTOR BANKS IN INDIA <i>M. ANBALAGAN & M. GURUSAMY</i>	141
	REQUEST FOR FEEDBACK	148

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CRYPTOGRAPHY: THE ESSENTIAL PART OF MODERN ERA

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ABSTRACT

In today's era cryptography is an important part of preventing private data from being stolen. It can be used to authenticate that the sender of a message is the actual sender and not a fraud. For sending the message many types of algorithms are used so that a message can send without any alteration. It ensures confidentiality because only a reader with the correct deciphering algorithm or key can read the encrypted message. Finally, it can protect the integrity of information by ensuring that messages have not been altered. Many types of cryptography algorithms are used but in this paper we introduce public key cryptography for strong authentication.

KEYWORDS

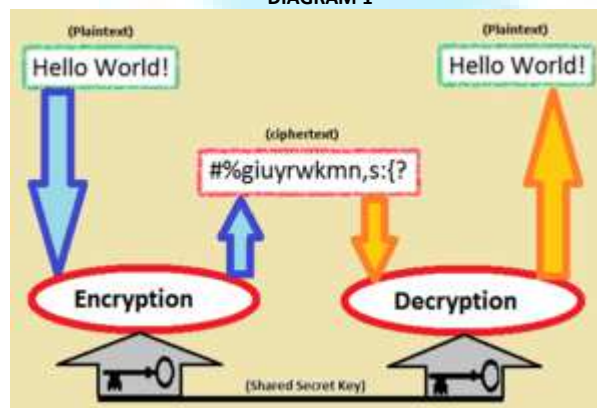
cryptography, private data.

INTRODUCTION

Cryptography comes from Greek words meaning "hidden writing". It is the science of hiding information so that unauthorized users cannot read the message. It converts readable data or cleartext into encoded data called ciphertext. This process is called encryption. Decryption is the reverse, in other words, moving from the unintelligible cipher text back to plaintext. A cipher (or cypher) is a pair of algorithms that create the encryption and the reversing decryption. By encryption and decryption the original message can be send to the receiver. In this paper firstly we describe about cryptography. In second part of paper three types of algorithms that are used for encrypt or decrypt the messages are discussed. Last part of the paper tells about public key encryption.

This diagram gives the brief idea about cryptography.

DIAGRAM 1



[2]

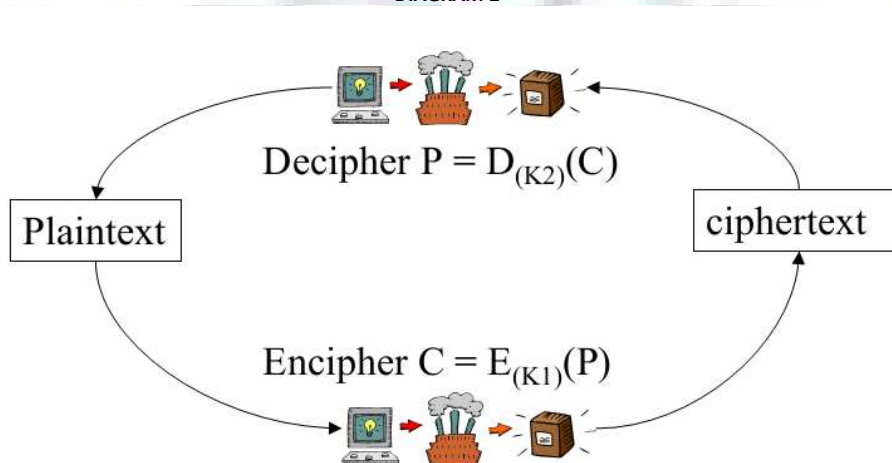
There is one more word that is frequently used in encryption and decryption is KEY. Some algorithm used public key and some used private key.

Public key:- This is the key that is known to everyone.

Private Key:- This is the key that is known only to receiver and sender.

Below the diagram shows how the plaintext is converted into ciphertext and then again decrypted using key.

DIAGRAM 2



[1]

Cryptography can be divided into several areas of study. Three types of algorithms used for encryption are:

- Hashing
- Symmetric, also called private or secret key

- Asymmetric, also called public key

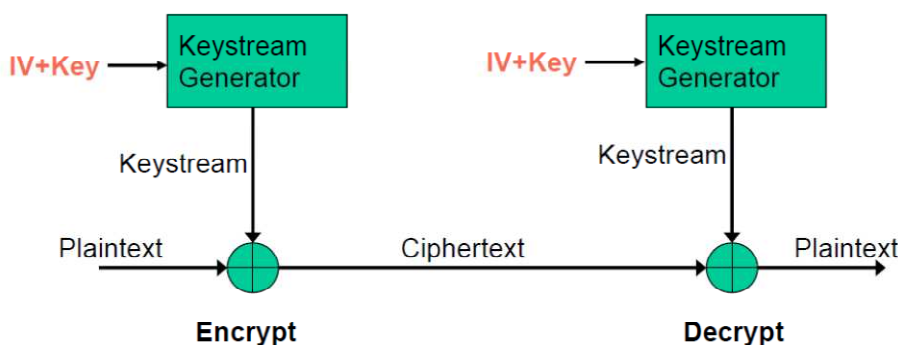
Hashing:-Cryptographic hash functions are the cryptographic algorithms that take a message of any length as input, and output a short, fixed length hash which can be used in (for example) a digital signature. A hashing algorithm is used to create an irreversible code of a piece of information. This hashed code is called a *hash* or *digest* and is unique to the information and can be used as a signature for the data. A hash is used for comparison purposes to make sure data has not been changed; thus it ensures the integrity of a message.[3]For the good hash functions, the thing is sure that an attacker cannot find two messages that produce the same hash. MD4 is a long-used hash function which is now broken by the hackers. MD5, a strengthened variant of MD4, is also widely used but broken in practice.[2] The U.S. National Security Agency developed the Secure Hash Algorithm series of MD5-like hash functions. SHA-0 was a flawed algorithm that the agency withdrew. SHA-1 is widely deployed and more secure than MD5, but cryptanalysts have identified attacks against it. The SHA-2 family improves on SHA-1, but it isn't yet widely deployed. Thus a hash function design competition is underway and meant to select a new U.S. national standard, to be called SHA-3, by 2012.Message authentication codes (MACs) are much like cryptographic hash functions, except that a secret key can be used to authenticate the hash value upon receipt. [2]

Symmetric Key Cryptography:-Symmetric key cryptography refers to those encryption methods in which both the sender and receiver share the same key (or, less commonly, in which their keys are different, but related in an easily computable way). This was the only kind of encryption publicly known until June 1976. Symmetric key ciphers are implemented as either block ciphers or stream ciphers. A block cipher enciphers input in blocks of plaintext and the stream cipher uses individual characters as the input form.

Stream Cipher:-Stream cipher is more suitable for binary strings.

DIAGRAM 3

How does a stream cipher work?

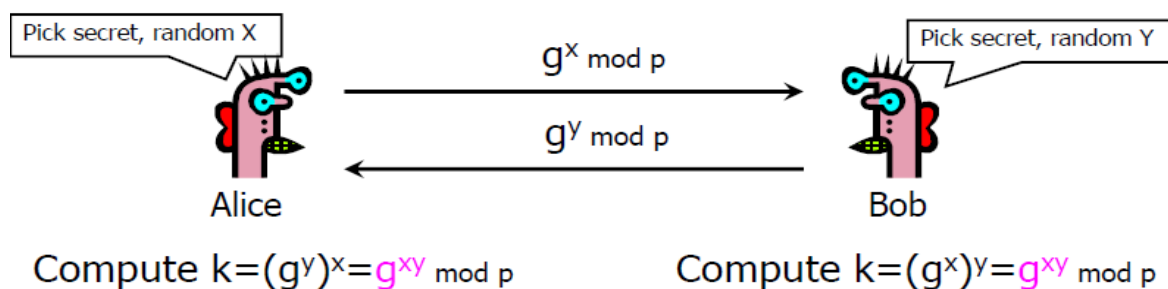


Stream ciphers, in contrast to the 'block' type, create an arbitrarily long stream of key material, which is combined with the plaintext bit-by-bit or character-by-character, somewhat like the one-time pad.[4] In a stream cipher, the output stream is created based on a hidden internal state which changes as the cipher operates. That internal state is initially set up using the secret key material. RC4 is a widely used stream cipher.[4]

Block Cipher:- Block ciphers can also be used as stream ciphers. The Data Encryption Standard (DES) and the Advanced Encryption Standard (AES) are the two main block cipher designs. These have been designated cryptography standards by the US government. After the adoption of AES design, DES's designation was finally withdrawn. Despite its deprecation as an official standard, DES remains quite popular and it is used across a wide range of applications from ATM encryption to e-mail privacy and secure remote access. After that many other block ciphers have been designed and released, with considerable variation in quality. Many have been thoroughly broken, such as FEAL.

Public-Key Cryptography:- In Symmetric-key cryptosystems the system uses the same key for encryption and decryption of a message, though a message or group of messages may have a different key than others. A major disadvantage of symmetric ciphers is the key management necessary to use them securely. Each distinct pair of communicating parties must share a different key, and possibly each cipher text exchanged as well. The number of keys required increases as the square of the number of network members, which very quickly requires complex key management schemes to keep them all strong and secret. So the management of key is the main problem in symmetric key cryptography. In a groundbreaking 1976 paper, Whitfield Diffie and Martin Hellman proposed the notion of *public-key* (also, more generally, called *asymmetric key*) cryptography in which two different but mathematically related keys are used—a *public* key and a *private* key.[2] A public key system is so constructed that calculation of one key (the 'private key') is computationally infeasible from the other (the 'public key'), even though they are necessarily related. Instead, both keys are generated secretly, as an interrelated pair.[2] In public-key cryptosystems, the public key is freely distributed, while its paired private key must remain secret. In a public-key encryption system, the *public key* is used for encryption, while the *private* or *secret key* is used for decryption. Diffie and Hellman did widespread academic efforts in finding a practical public-key encryption system. But this race was finally won in 1978 by Ronald Rivest, Adi Shamir, and Len Adleman, whose solution has since become known as the RSA algorithm.[2]The Diffie–Hellman and RSA algorithms, in addition to being the first publicly known examples of high quality public-key algorithms, have been among the most widely used.[2] Others include the Cramer–Shoup cryptosystem, ElGamal encryption, and various elliptic curve techniques.[2]

DIAGRAM 4



[8]

Public-key cryptography can also be used for the implementation of digital signature schemes. A digital signature is significant of an ordinary signature. They both have the characteristic of being easy for a user to produce, but difficult for anyone else to forge. Digital signatures can also be permanently tied to the content of the message being signed. That's the reason they cannot then be moved from one document to another, for any attempt will be detectable. In digital signature schemes, there are two algorithms: one for *signing*, in which a secret key is used to process the message (or a hash of the message, or both), and one for *verification*, in which the matching public key is used with the message to check the validity of the signature. RSA and DSA are two of the most popular digital signature schemes.[2] Digital signatures are central to the operation of public key infrastructures and many network security schemes (e.g., SSL/TLS, many VPNs, etc.). These algorithms are most often based on the computational complexity of "hard" problems, often from number theory. For example, the hardness of RSA is related to the integer factorization problem, while Diffie-Hellman and DSA are related to the discrete logarithm problem. More recently, *elliptic curve cryptography* has developed in which security is based on number theoretic problems involving elliptic curves.[2] Because of the difficulty of the underlying problems, most public-key algorithms involve operations such as modular multiplication and exponentiation, which are much more computationally expensive than the techniques used in most block ciphers, especially with typical key sizes.[2] As a result, public-key cryptosystems are commonly hybrid cryptosystems, in which a fast high-quality symmetric-key encryption algorithm is used for the message itself, while the relevant symmetric key is sent with the message, but encrypted using a public-key algorithm. Similarly, hybrid signature schemes are often used, in which a cryptographic hash function is computed, and only the resulting hash is digitally signed.[2]

CONCLUSION

Secrecy is at the heart of cryptography. Security is at times viewed as a standalone component of a system's architecture, where a separate module provides security. To achieve a secure system, security must be assimilated into every component, since components designed without security can become a weak point for attacker to attack. In early cryptography, there was a confusion about what was to be kept secret. But in modern era Cryptography this problem is about to finish. Public Key Cryptography (PKC) has been the enabling technology underlying many security services and protocol sin traditional networks such as the Internet. After Diffie-Hellman PKC, in the context of wireless sensor networks, elliptic curve cryptography (ECC), one of the most efficient types of PKC, is being investigated to provide PKC support in sensor network applications so that the existing PKC-based solutions can be exploited.

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