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Secured Mobile Messaging for Android application by using 3D-AES, PGP and Stegnography

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ABSTRACT: Today the age of information technology has transformed the ways we communicate with each other. We send emails, send SMS, send message using social networking sites and many more. The uses of computers, smart phones and clouds have become an integral part of our life for sharing information with each other. Thus introduction of all these means have also given rise to misuse of information by third party which can steal our private information. Thus we are thinking of using cryptography for securing our information. Today there are many cryptographic algorithms available for securing data but those are common from AES to RSA. So we are thinking of enhancing the security by using an advanced version of AES called as 3D-AES which generates a symmetric key by shuffling the original key array three times and making the key better each time it is shuffled. Thus the final output key will be more strong then a normal AES key. It will help secure the data more accurately than the normal one. The studies should reflect a lower encryption time and more security then the normal one. The other technique is used PGP for encryption and Compress the encrypted message to reduce its length, using Shannon fano algorithm technique.

KEYWORDS: 3D-AES; Encryption; Block cipher; Security; Compression; Message;Mobile Application.

I. INTRODUCTION

SMS stands for Short Message Service. It is a technology that enables the sending and receiving of messages between mobile phones. Adding text messaging functionality to mobile devices began in the early 1980s. The first action plan of the CEPT Group GSM was approved in December 1982, requesting that, "The services and facilities offered in the public switched telephone networks and public data networks, should be available in the mobile system." This plan included the exchange of text messages either directly between mobile stations, or transmitted via message handling systems in use at that time.

The SMS concept was developed in the Franco-German GSM cooperation in 1984 by FriedhelmHillebrand and Bernard Ghillebaert. The GSM is optimized for telephony, since this was identified as its main application. The key idea for SMS was to use this telephone-optimized system, and to transport messages on the signaling paths needed to control the telephone traffic during periods when no signalling traffic existed. In this way, unused resources in the system could be used to transport messages at minimal cost. However, it was compulsory to limit the length of the messages to 128 bytes (later improved to 160 seven-bit characters) so that the messages could fit into the existing signaling formats. SMS could be applied in every mobile station by updating its software. Hence, a large base of SMS capable terminals and networks existed when people began to use SMS. SMS first performed in Europe in 1992. Later it was ported to wireless technologies like CDMA and TDMA.

The GSM and SMS standards were originally developed by ETSI. ETSI is the abbreviation for European Telecommunications Standards Institute.[1] Now the 3GPP (Third Generation Partnership Project) is responsible for the development and maintenance of the GSM and SMS standards. The rapid development in mobile communication has transformed SMS as common tool for business and public messaging. SMS services are growing day by day. With SMS, people can easily share personal and official messages in a cost effective way. SMS enables the transmission of up to 1120 bits alphanumeric messages between mobile phones and external systems. It uses SMS center (SMS-C) for

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its routing operation in a network and can be transmitted into another network through the SMS gateway.[2] SMS usage is weak with security concerns, such as eavesdropping, interception and modification. SMS messages are transmitted as plaintext between the mobile stations and the SMS center using the wireless network. SMS content are stored in the systems of the network operators and can easily be read by their personnel.
The A5 algorithm, which is the GSM standard for encrypting transmitted information, can easily be compromised. Therefore, there is a need to provide an additional encryption on the transmitted messages. As suggested by the name Short Message Service, the data that can be held by an SMS message is very limited. One SMS message can contain at most 140 bytes (1120 bits) of data, so one SMS message can contain up to:

- 160 characters if 7-bit character encoding is used.
- 70 characters if 16-bit Unicode UCS2 (2-byte Universal Character Set) character encoding is used.

SMS text messaging supports languages internationally. It works fine with all languages supported by Unicode, including Arabic, Chinese, Japanese and Korean. SMS is a communication service standardized in the GSM mobile communication systems; it can be sent and received simultaneously with GSM voice, data and fax calls [3]. This is possible because whereas voice, data and fax calls take over a dedicated radio channel for the duration of the call, short messages travel over and above the radio channel using the signaling path. Using communications protocols such as Short Message Peer-to-Peer (SMPP) allow the interchange of short text messages between mobile telephone devices as shown in Fig. 1 that describe traveling of SMS between parties.

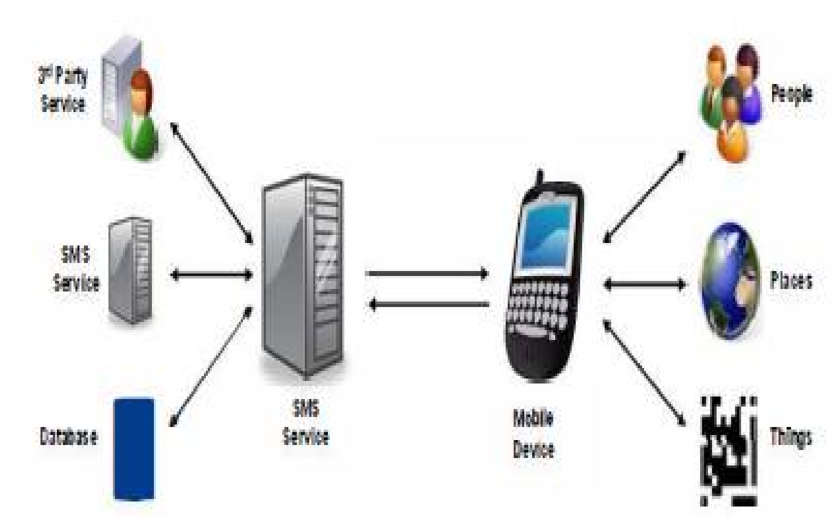

Fig.1 Basic traveling of SMS

SMS messages do not require the mobile phone to be active and within range, as they will be held for a number of days until the phone is active and within range. SMS are transmitted within the same cell or to anyone with roaming skill. The SMS is a store and forward service, and is not sent directly but delivered via an SMS Center (SMSC). SMSC is a network element in the mobile telephone network, in which SMS is stored until the destination device becomes available. Each mobile telephone network that supports SMS has one or more messaging centers to handle and manage the short messages.

- **Short Message Service architecture**

The network architecture of short message service in GSM is illustrated in Fig 2. In this architecture, the short message is first delivered from the Mobile Device A to a short message service center (SM-SC) through the base station system (BSS), the mobile switching center (MSC). The SM-SC then forwards the message to the GSM network through a specific GSM MSC called the short message service gateway MSC (SMS GMSC). The SM-SC may connect to some GSM networks and to some SMS GMSCs in a GSM network. Following the GSM roaming protocol, the SMS GMSC

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locates the current MSC of the message receiver and forwards the message to that MSC. The MSC then broadcasts the message through the BSS to the destination Mobile Device A.

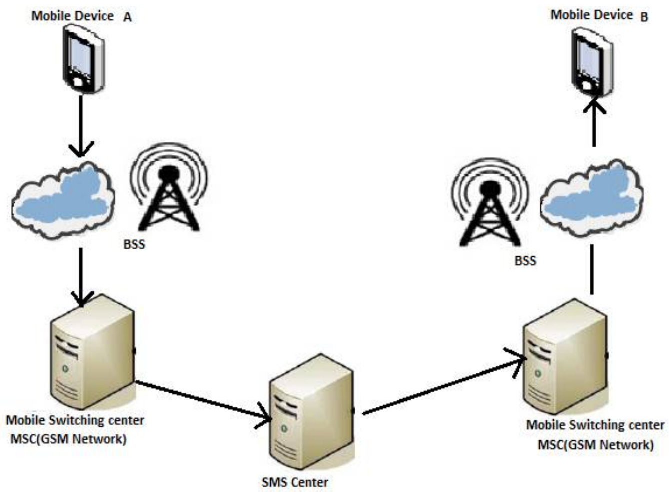

Fig.2 GSM short message service network architecture

- **SMS Security:**

SMS Security Threats understanding the basics of SMS security opens the door to preventing some common security threats in SMS usage: [3]

- Man-in-middle Attack: This is the network that authenticates users. The user does not authenticate network so the attacker can use a false BTS with the same mobile network code as the subscriber's authentic network to impersonate himself and perform a man-in-the-middle attack.
- Replay Attack: The attacker can misuse the previously exchanged messages between the subscriber and network in order to perform the replay attacks.
- Message Disclosure: Since encryption is not applied to short message transmission by default, messages could be intercepted and snooped during transmission. In addition, SMS messages are stored as plain text by the SMSC before they are successfully delivered to the intended recipient. These messages could be viewed by users in the SMSC who have access to the messaging system.
- Spamming: While using SMS as a legitimate marketing channel, many people have had the inconvenience of receiving SMS spam. The availability of bulk SMS broadcasting utilities makes it easy for virtually everyone to send out mass SMS messages.
- Denial of Service (DoS) Attacks: DoS attacks are made possible by sending repeated messages to a target mobile phone, making the victim's mobile phone inaccessible.
- SMS Phone Crashes: Some vulnerable mobile phones may crash if they receive a particular type of malformed short message. Once a malformed message is received, the infected phone becomes inoperable.
- SMS Viruses: There have been no reports of viruses being attached to short messages, but as mobile phones are getting more powerful and programmable; the potential of viruses being spread through SMS is becoming greater.
- SMS Phishing: SMS phishing is a combination of SMS and phishing. Similar to an Internet phishing attack using email, attackers are attempting to fool mobile phone users with bogus text messages. When users are taken in by a bogus text message, they may connect to a website provided in the SMS message, and be tricked into download a malware application into their mobile phones.

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II. LITERATURE SURVEY OF DIFFERENT TECHNIQUES FOR SECURING SMS

All the fancy encryption algorithm that we have talked about earlier are mostly used for two different types of encryption:

- Symmetric key algorithmsuse related or identical encryption keys for both encryption and decryption.
- Asymmetric key algorithmsuse different keys for encryption and decryption—this is usually referred to as Public-key Cryptography.

- Symmetric-key Encryption

Data cryptography mainly is the scrambling of the content of the data, such as text, image, audio, video and so forth to make the data unreadable, invisible or meaningless during transmission or storage is termed Encryption. And main aim of cryptography is to take care of data secure from invaders. The opposite process of getting back the original data from encrypted data is Decryption, which restores the original data. To encrypt data at cloud storage both symmetric-key and asymmetric-key algorithms can be used. But its having serious issues while handling huge database and transaction.

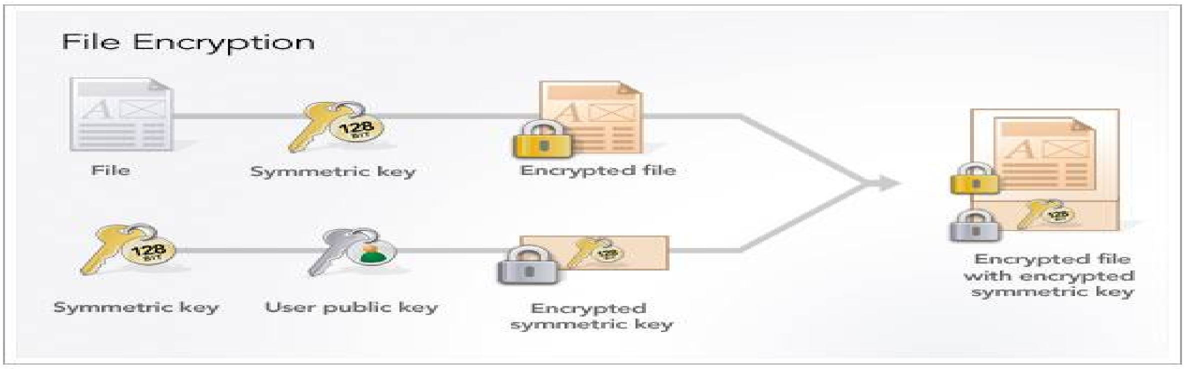

Fig 3: Symmetric-key Encryption

Symmetric-key algorithms are algorithms for cryptography that use the same cryptographic keys for both encryption of plaintext and decryption of ciphertext. The keys may be identical or there may be a simple transformation to go between the two keys. The keys, in practice, represent a shared secret between two or more parties that can be used to maintain a private information link. This requirement that both parties have access to the secret key is one of the main drawbacks of symmetric key encryption, in comparison to public-key encryption.

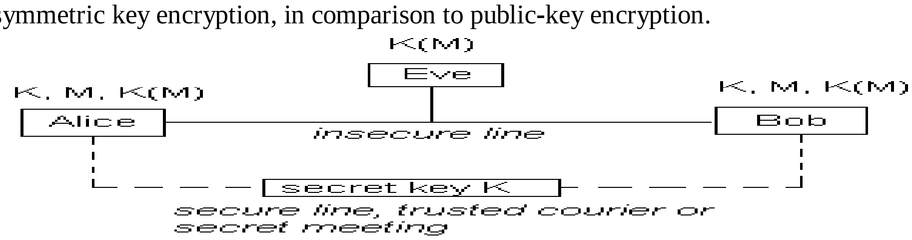

Fig 4: Public-key cryptography

Public-key cryptography, also known as asymmetric cryptography, is a class of cryptographic protocols based on algorithms that require two separate keys, one of which is secret (or private) and one of which is public. Although different, the two parts of this key pair are mathematically linked. The public key is used, for example, to encrypt plaintext or to verify a digital signature; whereas the private key is used for the opposite operation, in these examples to decrypt ciphertext or to create a digital signature.

1. The costs and complexities involved generally increase with the number of the decryption keys to be shared.
2. The encryption key and decryption key are different in public key encryption.

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3. Regarding availability of files, there are a series of cryptographic schemes which go as far asallowing a third-party auditor to check the availability of files on behalf of the data ownerwithout leaking anything about the data or without compromising the data owner's anonymity

- Asymmetric Key Encryption

In an asymmetric key system Fig .4, Bob and Alice have separate padlocks, instead of the single padlock with multiple keys from the symmetric example. Note: this is, of course, a greatly oversimplified example of how it really works, which is much more complicated, but you'll get the common idea. First, Alice asks Bob to send his open padlock to her through regular mail, keeping his key to himself. When Alice receives it she uses it to lock a box containing her message, and sends the locked box to Bob. Bob can then unlock the box with his key and read the message from Alice. To reply, Bob must similarly get Alice's open padlock to lock the box before sending it back to her.

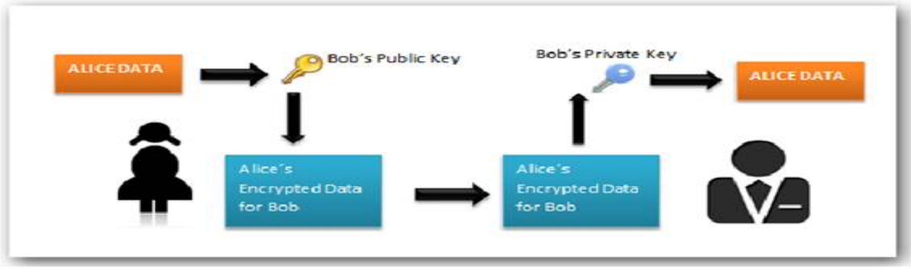

Fig. 5. Asymmetric Key Encryption

The serious advantage in an asymmetric key system is that Bob and Alice never need to send a copy of their keys to each other. This prevents a third party (perhaps, in the example, a corrupt postal worker) from copying a key while it is in transit, allowing said third party to spy on all future messages sent between Alice and Bob.

III. DEVELOPED SYSTEM ARCHITECTURE

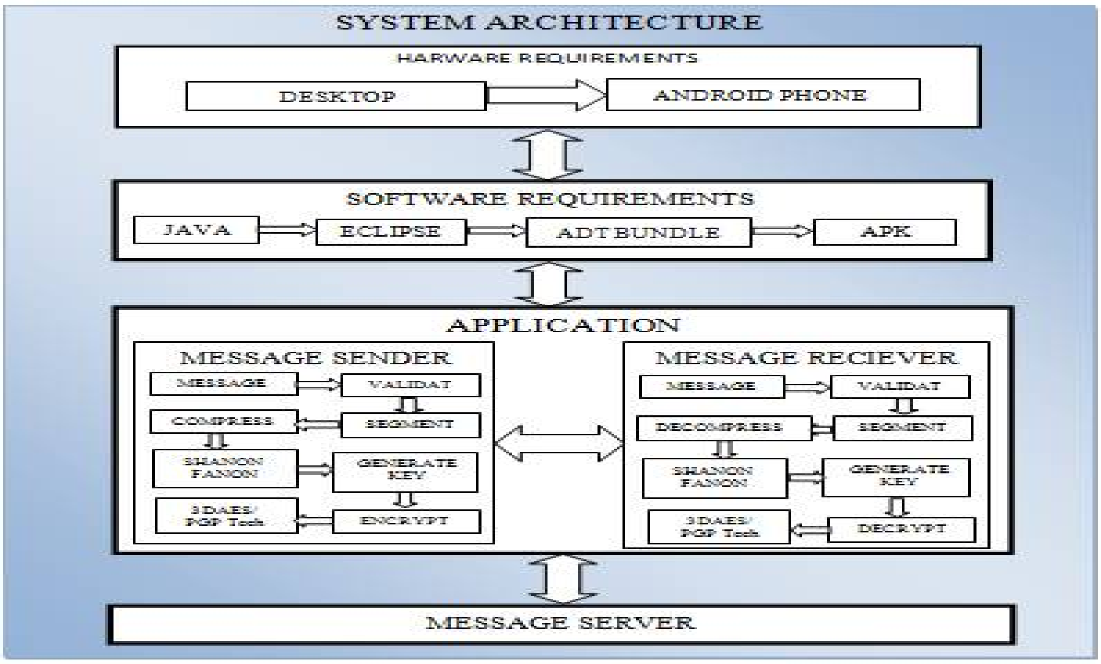

Fig 6. Proposed System 3D-AES/PGP Architecture

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I. 3D-AES Block Cipher:

The 3D-AES block cipher [5] is based on the AES block cipher [6][7] which is a key-alternating block cipher, composed of rotation key function, minimum 3 iterations of roundfunction and key mixing operations. The round function consists of nonlinear substitution function, permutation function and transposition function. A block diagram of the 3D-AES block cipher is given in Fig. 2 in the form of 4 x 16 bytes. The original message is called the plaintext, denoted P_i, where i = {0, 1, 2, 3}. The unreadable form is called the ciphertext, denoted by C_i, where i = {0, 1, 2, 3}. The secret master key is denoted by K. The transformation of P into C is called encryption and the reverse process is called decryption. The P, as it goes through each round of the cipher, is referred to as the cipher state, denoted as F. The 3D-AES block cipher is improved confusion performance [10] of round transformation.

A detailed description of all the layers of 3D-AES block cipher follows:

- $P^i_{D^n}$ is a plaintext for i^{th} slice at n^{th} cube.
- $C^i_{D^n}$ is a ciphertext for i^{th} slice at n^{th} cube.
- Q is a rotation key .
- D^n_Q is the output of n^{th} cube from arranging function at rotation key Q.
- E^i is an encryption function for i^{th} slice.

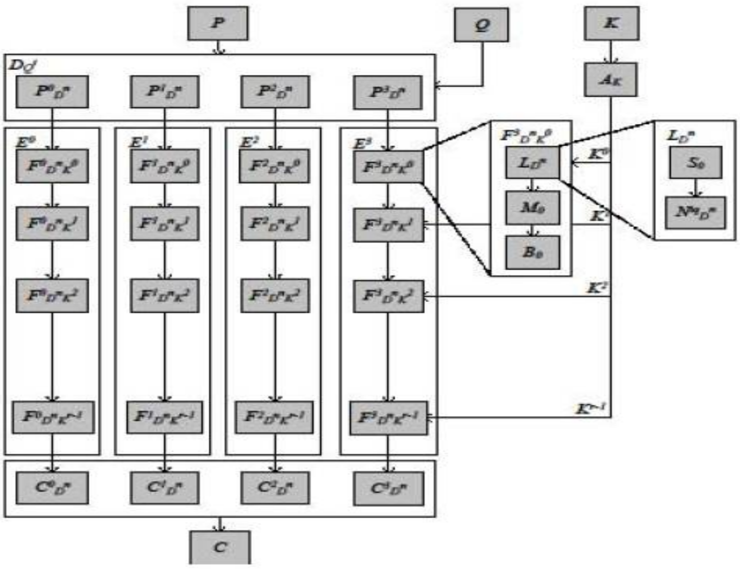

Fig.7: The structure of 3D-AES block cipher

- $F^i_{D^n K^r}$ is a output block of encryption function for i^{th} slice at cipher state for n^{th} cube in round r.
- K^r is the sub key used in round r.
- A_K is key scheduling function.
- $L^i_{D^n}$ is a output block of linear transformation function for i^{th} slice at Q rotation key at n^{th} cube.
- S_i is a nonlinear transformation of the i^{th} slice at round function .
- $N^{iq}_{D^n}$ is a rotation function at arranging function of i^{th} slice and q degree at n^{th} cube.
- M_i is a linear transformation of the i^{th} slice at round function.
- B_i is a XOR operation.

The 3D-AES block cipher identified the encryption and decryption functions. When r = 3, the output cipher state is the ciphertext. The third round of the 3D-AES block cipher operates on plaintext size of 16 x 4 bytes to produce an output ciphertext 64 bytes. The secret key size required by the 3D-AES block cipher is 16 bytes. All the operations in the 3D-AES block cipher are performed in the finite field of order 2^8, denoted by $GF(2^8)$.This immune-inspired block

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cipher adopted amino acid sequences model that can be rotate with a different angle. The q degree is based on the rotation angel for every i^{th}Slice where i = {1, 2, 3, 4} and q = {0, 1, 2, 3}.

II. Steganography

Text-Based Steganography: It makes use of features of English Language like inflexion, fixed word order and use of periphrases for hiding data rather than using properties of a statement. The steganography program for each user is easy. It further protects against eavesdropping on the embedded information. It is most secured technique and provides high security.

III. PGP (Pretty Good Privacy)

Pretty Good Privacy (PGP) is a data encryption and decryption computer program that provides cryptographic privacy and authentication for data communication. PGP is often used for signing, encrypting, and decrypting texts, e-mails, files, directories, and whole disk partitions and to increase the security of e-mail communications. It was created by Phil Zimmermann in 1991. Encryption: PGP combines some of the best features of both conservative and public key cryptography.

PGP is a hybrid cryptosystem. When a user encrypts plaintext with PGP, PGP first compresses the plaintext. Data compression saves transmission time and disk space and, more importantly, strengthens cryptographic security. PGP then creates a session key as shown in Fig. 6 which is a one-time-only secret key. This key is a random number generated from the random movements of your mouse and the keystrokes you type. This session key works with a very secure, fast conventional encryption algorithm to encrypt the plaintext; the result is ciphertext. Once the data is encrypted, the session key is then encrypted to the recipient's public key. This public key-encrypted session key is transmitted along with the ciphertext to the recipient.

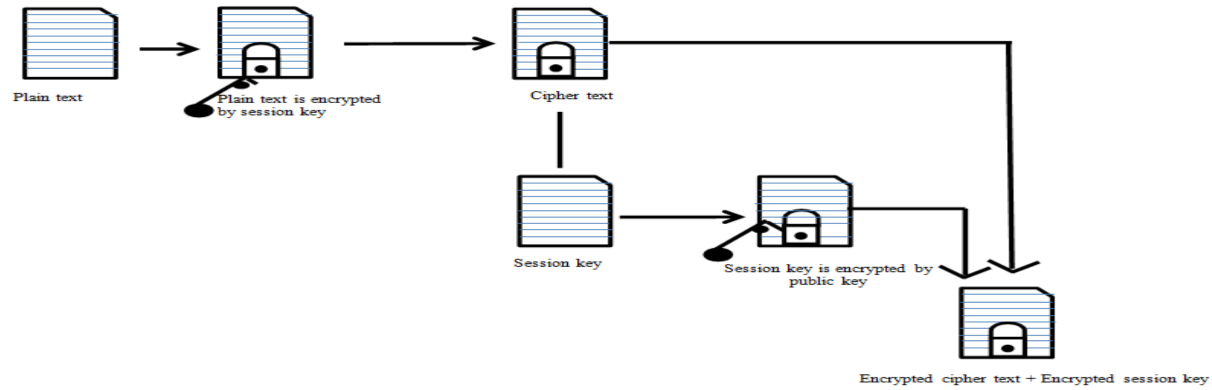

Fig. 8: Encryption using PGP technique

Decryption: Decryption works in the reverse as shown in fig. 7. The recipient's copy of PGP uses his private key to decrypt the temporary session key, which PGP then uses to decrypt the conventionally-encryptedciphertext.

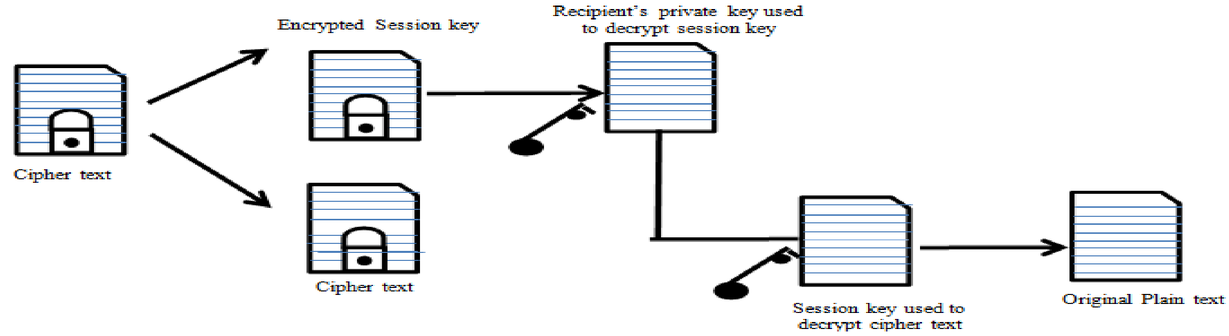

Fig. 9: Decryption using PGP technique

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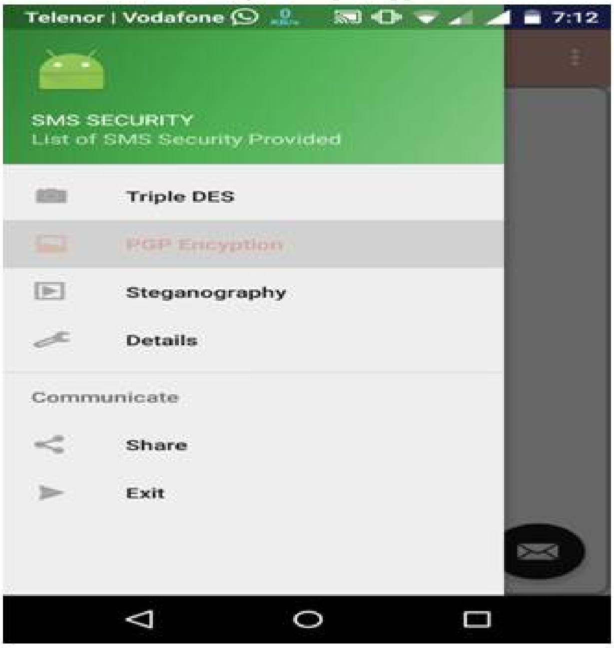
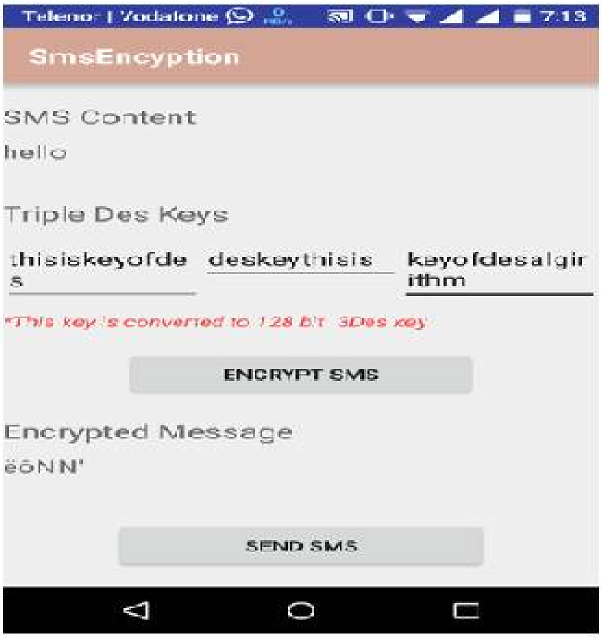
IV. Compression:

The second step is compression. The encrypt message usually gets larger than the original message leading to excessive charge in sending SMS encrypted message. Therefore data compression will be used on the encrypted message; this will reduce it bit size. Thereby reducing the additional cost incurred in sending SMS encrypted message[4]. When data compression is used in a data transmission application, speed is primary goal. Speed of transmission depends upon the number of bits sent. Compression can be classified as either lossy or lossless [6].

V. Case study of Secured Mobile Messaging for Android application:

Step 1: We are securing Mobile Messaging for Android application by using PGP, Stegnography and DES algorithm. It can be seen in following developed application;





Step 2:

SMS Encryption module takes a input as a short message and by using DES keys encrypt the SMS for security.

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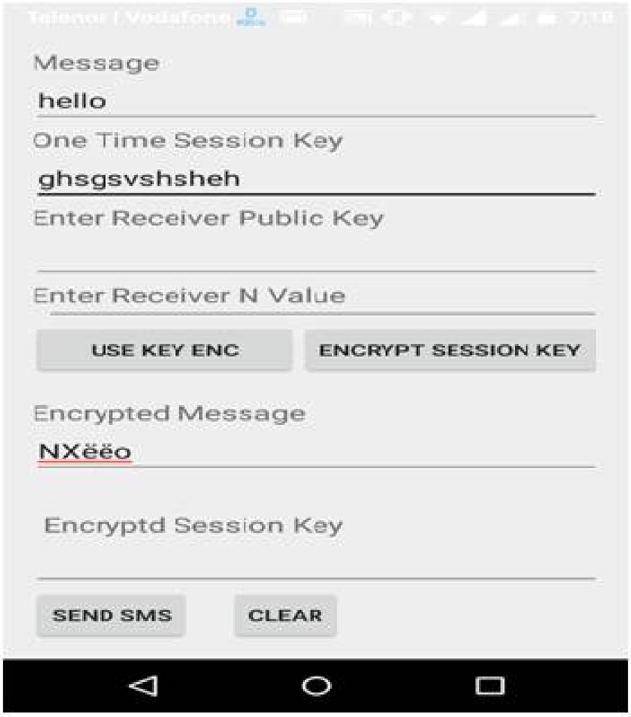
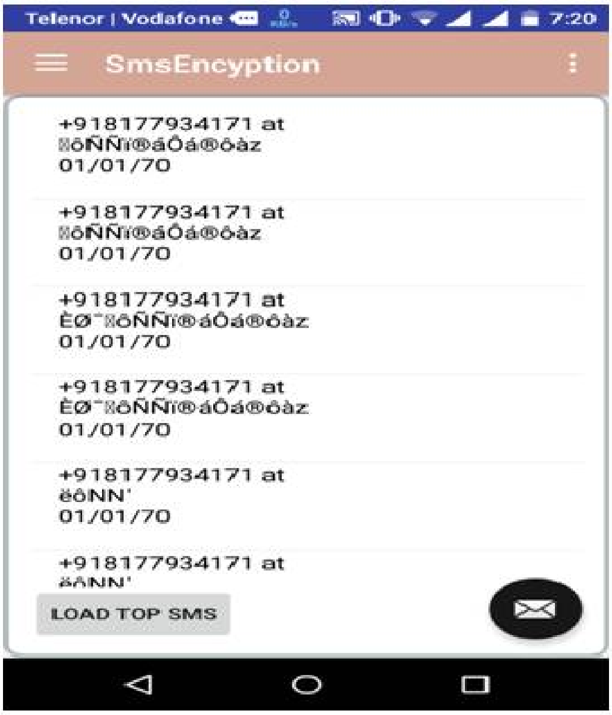
Step 3: At receiver side, receiver recive encrypted msg, it uses one time session key, receiver public key and N value for decrypting messages.





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IV. RESULT ANALYSIS

So by using triple layer encryption, 3D-AES, PGP and Shannon Fanosecurity algorithm we are able to provide more security of Mobile Messaging in Android application i.e. precision and recall value more than 95%.

Sr. No.	Messaging Security Technique	Precision %	Recall %
1	Reliability-based	21.4	15.4
2	DFT	31.4	45.8
3	Eventset	24.2	91.7
4	Developed System	95	97.43

V. CONCLUSION

The developed technique combines the encryption and compression process. It encrypts the SMS using 3D-AES algorithm and PGP.Since encrypted SMS compressed using a lossless algorithm, Shannon Fano algorithm. The advantage of this technique is achieving the protection criteria such as confidentiality and authenticity between two communication parties and at the same time decreasing the message lengths. This application is running on smartphones and does not require any other encryption device. Users can exchange the sensitive information via SMS through the developed technique that prevents from attackers.
By practically using we can say that our developed approach is giving security results more than 95% in terms of precision and 97.43% in terms of recall.

REFERENCES

1. A. Medani, A Gani, O.Zakaria, A.A. Zaidan “Review of mobile short message service security issues and techniques towords the solution”, Scientific Reaserch and Essays vol.6(6),pp. I 147-1 165,18 March, 201 IJ. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed,vol. 2. Oxford: Clarendon,1892,pp.68-73.
2.Tarek M Mahmoud, Bahgat A. Abdel-Iatef, Awny A Ahmed & Ahmed M Mahfouz, “Hybrid compresion encryption techniques for securing SMS”, International Journal of Computer Science and Security(UCSS),Volume(3):issue(6)K Elissa,”Title of paper if known,” unpublished.
3.NJ Croft and M.S Olivier, “Using an approximated one-time pad to secure short messaging service(SMS)”, Information and Computer Security Architecture(ICSA) Research Group.
4.S.R. Koituwakku,U,S. Amrasinghe, “Compression of lossless data compression algorithm for text data”. India journal of computer science and engineering VOL INo 4 I 6-425.
5.S.Ariffin, R.Mahmod,A. Jaafar and M.R.K. Arffin, “Byte Permutations in Block cipher Based on Immune Systems”, International Conference on Software Technology and Engineering 3rd(ICSTE 2011), ASME Press,New York,NY,2011.
6.NIST, “Fips197: Advanced Encryption Standard(AES)”, FIPS PUB 197 Federal Information Processing Standard Publication 197,Technical report, National Institue of Standard and Technology,2001.
7.J.Daemen, V. Rijmen, V. ,”The Design of Rijndael, AES-The Advanced Encryption Standard”,Springer-Verlag.2002.
8. Songyang Wu, ChengxiangTan , "A high security framework for SMS",IEEE-2009, 978-I-4244-4134-I/09.
9. W. Stallings, “Cryptography and network security”, Prentice Hall,New Jersey, United State, 2006.
10. D. Lisonek and M. Drahansky, “SMS encryption for mobilecommunication”, International Conference on Security Technology,Hainan Island, 2008, pp 198 – 201.
11. J. P. Albuja and E. V. Carrera, “Trusted SMS communication onmobile devices”, 11th Brazilian Workshop on Real-Time andEmbedded Systems, Pernambuco, Brazil, 2009, pp.165- 170.
12. M. Toorani and A.A.B. Shirazi, “SSMS-A secure SMS messagingprotocol for the m-payment systems”, Proceedings of the 13th IEEESymposium on Computers and Communications (ISCC'08),Marrakech, 2008, pp. 700-705.
13.RashmiChavan, ManojSabnees“Secured Mobile Messaging” 2012 International Conference on Computing, Electronics and Electrical Technologies [ICCEET].
14. S. Zhao, A. Aggarwal and S. Liu, “Building secure user-tousermessaging in mobile telecommunication networks”, Proceedings ofWireless Telecommunications Symposium, Pomona, CA, 2012,pp.151-157.