Abstract: Nowadays, security is the most significant thing in the communication field. Most of the data transmitted over the communication channel are highly confidential so it needs more security. But this confidential data are easily stolen by hackers and it affects the users’ privacy. Nowadays, so many encryption algorithms have been established to protect the original information of the users. But, Hash Function (HF) security is the most important primitive which used for data authentication and data integrity. The reconfigurable cryptography integrated with chip which used for cryptography. Hashing algorithm is used to generate the random number which also used as a key value for cryptography. In this paper, different kind of Secured Hash Algorithms (SHA) such as SHA-0, SHA-1, SHA-2, and SHA-3 in that the SHA-2 has different family (SHA-2F) such as SHA-224, SHA-256, SHA-384, and SHA-512 is studied.

Keyword: Encryption algorithms, Decryption, Hash function, Reconfigurable cryptographic, Secured Hash Algorithms.

I. INTRODUCTION

In recent years, security services have concentrated more on e-transaction, high throughput design, and medical field to protect the confidential data. The authentication performed based on cryptographic HF [1]. This Hash based nearest neighbor is mainly used for visual search, object detection, image matching, and local sensitivity. High dimensional binary codes consider as a hash function which has high efficiency [2]. The SHA algorithm has been published in the National Institute of Standard Technology (NIST) [3-4].The Black algorithm based hash function used for secure the data which maps with binary data [5]. For security, Advanced Encryption Standard (AES) based algorithms used in many research papers. RFID based security is one of the major process to secure the data with high confidential [6]. In the past few years, so many existing algorithms have been used for hashing based security. Bayat-Sarmadi et al. [7], designed a concurrent reliable algorithm with SHA-3 which has effective reliability.

Space of lightweight cryptographic hashing algorithm [8] used for permutation, pseudo random number generation and which also has random bit generator [9].The SHA processor with SHA-512, SHA-224, SHA-256 is used to get more clock frequency [10], and multi thresholding SHA-1 & SHA-2 algorithm has designed for padding process [11]. Many hashing algorithms have been designed based on SHA-0/1/2/3 [12-14], and these algorithms are briefly explained in below section.

This paper is organized as follows. Section 2, presents a discussion on Crypt-analytics Mechanism. Section 3, explains the application of the hashing algorithm. Section 4, explains the SHA algorithms. Section 4, explains some conventional literature papers. The conclusion is made in section 5.

II. CRYPT-ANALYTICS MECHANISM

Crypt-analytics is a strategy for sending the transmitter information in a specific frame. This transmitted information can also read by other users easily. To secure the information, cryptography is used in the transmission field. After encryption, the plain text converts into the Cipher Text (CT). With the help of key, the cipher text has is converted to original data [15].

![Fig. 1. Crypt-analytics Mechanism](image)

2.1. Key:
This is used to perform the cryptography. This can be generate from manually or any source circuit.

2.2. Plain Text:
The input information is called as a plain text. If you can imagine, “hashing function” is a
plain text which is used to perform the encryption.

2.3. Encryption

After performing encryption, a text file is generated which denoted as CT. Assume, "Azx143@qz12+124" is a CT created for "hashing function". This CT is used to safe an input information. While seeing this CT, no one can understand the input information.

2.4. Decryption:

From the CT, the decryption has been performed. The person who has CT along with decrypted key, they can get the input information from the CT. The same key is required to decrypt the information.

III. APPLICATION OF HASH FUNCTION

- Data authentication is used to check whether the data has been modified or not.
- Data signatures are encrypted with a private key.
- The Password is stored in the memory. It is more difficult to retrieve the password form the memory.
- Key has been generated from passphrase which can be made to prevent the brute force attacks.
- A Pseudorandom number is used to generate the iterated value.
- Virus detection and check the hash file on a system

IV. SECURED HASHING ALGORITHM

In this section, different kind of SHA algorithm is described which is used to secure the data with high confidentiality.

4.1. SHA-0

This algorithm contains 160-bit hash function. Initially, this algorithm named as SHA-0 which generate the significant error. Hence, the SHA-0 is changed as SHA-1.

4.2. SHA-1

This algorithm produces the Message Digest (MD) based on MD4 and MD5 principles. The SHA-1 algorithm partially differs from SHA-0. Single bitwise rotation is the major difference between the SHA-0 and SHA-1. SHA-1 produces a 160-bit hash value which is called as MD. This hash value is represented as a hexadecimal value which has 40 digits long. This SHA-1 has 5 steps which are explained as follows.

Step 1: Bit padding process is performed.

Step 2: Appending length process is performed in this step which calculates the excluding length.

Step 3: The input text is segregated into 512-bit blocks.

Step 4: Chaining variables should be initialized. Total 5 chaining variables have been initialized and each chaining variables has 32 bit.

Step 5: Process block
- Chaining variables should be copied
- 512 bits split into 16 sub blocks
- Process 4 rounds of 20 steps

SHA-1: The function H operates as follows,
- Each and every round contains 20 steps which is replaced the 5 buffer words such as F, G, I, J and K with (K + f(t, G, H, I) + (F<<5) + X_t + K_t), F, (G<<30), I, J)
- Step number is mentioned as t.
- Nonlinear function for a round is mentioned as f (t, G, H, I).
- From the message block, the X_t is derived and K_t constant value is derived from sine.

SHA-1 is most widely used applications which include the TLS, SSL, PGP, SSH, and IP.

4.3. SHA-2

The SHA-2 algorithm is a modified version of the SHA-1 algorithm. The SHA-2 has some family
which is represent as SHA-2F. These algorithms are computed with different bit words such as 64 and 32. But, the structures of the algorithms are identical except the number of rounds.

First, two algorithms have truncated and it produces the SHA-224 and SHA-384. SHA-512 is generating by truncating SHA-512/224 and SHA-512/256.

The different kind of hashing algorithms are used to recompute some module such as shift registers, basic operation, and constant storage. From the analysis of the constants $K_t$, four 32 bit SHA-1 and eighty 64 bit SHA-384/512 was designed. The entire algorithm should be used for both encryption and decryption.

4.3.1. X_i architecture

Based on the algorithm, in initial 16 steps, $X_i$ is equal to $M_t$. For other steps it depends on algorithm process. For SHA-1 the remaining $X_i$ is evaluated using Eq. (1).

$$X_i = (X_{i-1} \oplus X_{i-8} \oplus X_{i-14} \oplus X_{i-16}) \ll 1$$

(1)

For remaining HA, the $X_i$ is calculated using Eq.2.

$$X_i = \sigma_1(X_{i-2}) + X_{i-7} + \sigma_0(X_{i-15}) + X_{i-16}$$

(2)
computation is realized by using of MUX. For Initial 16 step values, the MUX selects the 32/64-bit word from the 52/1024-bit data as input which is stored in the initial register and $X_i$ register. The architecture of Carry Look Ahead Adder (CLA) and Carry Save Adder (CSA) is used to improve the performance of $X_i$ architecture.

### 4.4. SHA - 3

This algorithm uses the sponge construction in which data absorbed into the sponge and the result is called as squeezed. The information is XORed into a subset of the state in absorption phase. In SHA-3, the state contains 5x5 array of 64-bits words. The permutation is performed by XOR operation.

#### 4.4.1. Block Permutation (BP):

- Here, W is mentioned as 21 bit.
- State = 5x5xw bits array.
- BP function has (12+2x1) iterations of 5 sub rounds ($f = l, \alpha, \beta, \mu, \chi$)
  - $l$: one word is created by XOR round constant
  - $\alpha$: Bitwise rows
  - $\beta$: permute the 25 words
  - $\mu$: bitwise rotation
  - $\chi$: XOR with two 5xw columns neighbors.

![Fig. 5. SHA-3 operation](image)

The SHA-3 family contains four different hash functions such as SHA3-224, SHA3-256, SHA3-384 and SHA3-512. This SHA3-512 has two different functions like SHAKE 256 and SHAKE 128. Overall, the SHA algorithms are used to prevent the data from the hackers.

### V. LITERATURE SURVEY

Researchers suggested several hashing algorithms for the security. In this scenario, a brief evaluation of some important contributions to the existing methods are presented below.

| Author               | Methodology                                                                 | Advantage                                      | Disadvantage                                                                 | Performance Measure                                                                 |
|----------------------|----------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Jaroshaw Sugier [15] | FPGA implementation of BLAKE hash algorithm with block memory resources.   | Successfully qualified in the end stage and KECCAK also considered for suitable cryptographic solution. | The occupied memory is more, so its complex to store all the message information. | Slices – 2604 (x1), 4638 (x2), 8382 (x4), 10657 (x5). LUT – 4961 (x1), 8684 (x2), 16142 (x4), 20448 (x5). |
| Pei Luo et al. [16]  | Efficient Algebraic Fault Analysis (AFA) with SHA-3 under relaxed fault models. | More efficient. The faults were created by single byte fault model which has very less fault. | The security of the entire algorithm is less.                                  | 16 bit fault model: 29.10s for SHA3-224 and 14.61s for SHA3-256                  |
In this paper, different SHA algorithms such as SHA-0/1/2/3, SHA-224, SHA-256, SHA-384, and SHA-512 are explained. In SHA, $X_i$ architecture designed by using optimal CSA and CLA adder to reduce the hardware utilization. The overall application and requirements of the hashing algorithms have been detailed in this paper. The security systems in communication field deals with so many problems such as less memory storage, less efficiency, less key security, less efficiency in encryption and decryption also it requires more power and area for implementation. These all problems give an easy way for the hackers to steal/hack the users’ information. In the future, a new hashing algorithm can be introduced with further optimal adder which will reduce both the area and power of the implementation.

VI. CONCLUSION

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