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ARO_EDGE: A Technique to Ensure Data Security in Internet of Things (IoT)

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Abstract **- Recently, e-health care, smart home, smart city, smart car and smart car services have been receiving attention all over the world. In smart health care, there are many sensors are communicating between each other and connected to the global network connection. Therefore, there is a problem in securing the data sensed from the various medical IoT devices. Lightweight and efficient way of providing secure communication in the IoT are the need of the hour. To overcome this problem, a technique has been proposed. This paper proposes a confidentiality technique, named ARO_EDGE to secure the data in IoT devices. This proposed confidentiality technique is based on data obfuscation technique to prevent the data from the attackers and unauthorized users.**

Keywords: **Internet of Things, Smart Healthcare, Data Security, Obfuscation Technique**

I. INTRODUCTION

Internet of Things (IoT) provides a platform to connect anything from anyplace and anytime. It aims to integrate physical objects, peoples, computing systems over a common network to interact and communicate between each other. There is a vast increase in number of users, services and applications in IoT. The expected volume of connected devices require the use of machine-to-machine communication meaning that humans will no longer have direct control over with whom or what our devices are communicating [1]. There are many applications available in IoT such as E-Health, Retail & Logistics, Smart Transportation, Smart Environment, Smart Home, Energy Conservation, Environmental Monitoring etc [2]. In IoT, many types of sensors, smart devices and RFID tags collect data depending on their purpose, some of the data might be highly sensitive such as data collected from smart healthcare devices and smart home devices. These calls for the security on the device which must be secure the collected data and send it to the common gateway/server.

To overcome the security issues, IoT needs identity authentication mechanisms and protection of the confidentiality of the data. Data confidentiality, integrity and availability are the three basic areas of security. The main objective of data confidentiality is protecting the privacy of sensitive information by using some mechanisms and avoiding the unauthorized access. For IoT devices, data confidentiality means the data collected by the sensors should not be transmitted to an unauthorized user. Data encryption is a mechanism to ensure the data confidentiality. Where, the encrypted data convert into cipher text and unauthorized users cannot easily access the data. In the IoT system, the data is encrypted in the Wireless Sensor Network (WSN) nodes and transmitting to the gateway.

In this paper, a cryptographic algorithm to enhance the data security at the device level is proposed. This algorithm deals with the data security based on cryptographic techniques. The proposed algorithm, however, is mainly focused on data collected from the IoT sensors / devices. T he requirements of developing a new cryptographic algorithm are strong security mechanism (encryption/decryption) with low power. The main reason for developing a new cryptographic algorithm is to enhance the efficiency of end-to-end communications in low resources smart devices.

II. RELATED WORKS

Saurabh Singh *et al.* [3] discussed various lightweight cryptographic algorithms such as lightweight stream ciphers block ciphers and hash function. Based on block size, key size, number of rounds, and structures they analysed the cryptographic algorithms. They focused on research security issues and challenges and discussed the security architecture in IoT for constrained device environment. They proposed Hybrid Lightweight Algorithm (HLA) and explained with a service scenario of a smart home for an improvement of resource constrained IoT environment. The proposed HLA is a combination of lightweight symmetric algorithm and lightweight asymmetric algorithm to minimize computation time, consume less power, fast efficient and assures all the possible security. The HLA scheme provides two encryption schemes based on the analysis of device parameters such as data size, memory space, computation power, and battery power. Based on the parameters the lightweight algorithms are applied to the smart devices.

Lobna Yehia *et al.* [4] discussed the security for healthcare systems mainly focusing on the data security. They proposed a hybrid security technique for internet of things healthcare applications. Here, they combined symmetric encryption and asymmetric encryption to secure the

TABLE I OBFUSCATION AND DE-OBFUSCATION TECHNIQUE

Pseudo code of proposed ARO_EDGE Obfuscation technique	**Pseudo code of proposed ARO_EDGE De-obfuscation technique**
• Start • PT ← plaintext • N ← length(PT) *//Generate a Key value and store it in PV(i)* • for i ← 0 to N-1 • TV(i) ← PT(i) + PV(i) *//Count the digits in TV(i) and split into digits (D)* • Count = D(i) • SV(i) ← SQRT (D(i)) *// Append the single digit value with '0'* *//Interweave the square of the digits* • WV(i) ← interweave(SV(i)) *//Find the module value MOD for WV using PV(i)* • MV(i) ← WV(i)%PV(i) • SK(i) ← WV(i)/PV(i) • CT(i) ← MV(i) • end for • end	• Start • CT← Cipher text *// Count the values in cipher text* • N ← count (CT(i)) • for i ← 0 to N-1 *//Multiply the secret key value with the key generated and sum with the cipher text value* • MUL(i) ← SK(i)*PT(i) + CT(i) *//Interweave the square of the digits* • WV(i) ← interweave(MUL(i)) *//find the square root* • ST(i) ← SQRT(WV(i)) *//Subtract the value with the key generated* • PT(i) ← SUB(ST(i)) • Plaintext ← PT(i) • end for • end

VI. ARO_EDGE OBFUSCATION PROCEDURE WITH SAMPLE DATA

Consider the following values for obfuscation

25 37 42 15 57

Step 1: Count the number of values (N) in Plain Text (PT)

Step 2: The plain text values are

PT(i)	Value
PT(0)	25
PT(1)	37
PT(2)	42
PT(3)	15
PT(4)	57

Step 3: Generate key value. Key – single digit prime value PV(i). Starting from 2 and goes on.. Key – 2, 3, 5, 7

PV(i)	Value	Key
PV(0)	25	2
PV(1)	37	3
PV(2)	42	5
PV(3)	15	7
PV(4)	57	2

Step 4: Sum the key value with the plain text

TV(i)	Value
TV(0)	27
TV(1)	40
TV(2)	47
TV(3)	22
TV(4)	59

Step 5: Calculate the square for each digit of the value and append the value with '0'

SV(i)	Value
SV(0)	04 49
SV(1)	16 00
SV(2)	16 49
SV(3)	04 04
SV(4)	25 81

Step 6: Interweave the square digits SV(i)

WV(i)	Value
WV(0)	0449
WV(1)	1060
WV(2)	1469
WV(3)	0044
WV(4)	2851

Find the secret key value SK(i) = WV(i) / PV(i)

SK(i)	Value
SK(0)	224.5
SK(1)	353.3
SK(2)	293.8
SK(3)	6.2
SK(4)	1425.5

Step 7: MV(i) = Modulus of WV(i) by using the key PV(i)
MV(i) = Cipher Text (CT(i))

MV(i)	Value	CT(i)
MV(0)	1	CT(0)
MV(1)	1	CT(1)
MV(2)	4	CT(2)
MV(3)	2	CT(3)
MV(4)	1	CT(4)

VII. ARO_EDGE DE-OBFUSCATION PROCEDURE WITH SAMPLE DATA

Step 1: Multiply the secret key value with the key generated and sum with the cipher text value

CT(i)	Value
CT(0)	1
CT(1)	1
CT(2)	4
CT(3)	2
CT(4)	1

MUL(i) ← SK(i)*PT(i) + CT(i)

MUL(i)	Value
MUL(0)	0449
MUL (1)	1060
MUL (2)	1469
MUL (3)	0044
MUL (4)	2851

Step 2: Interweave the digits of the ciphertext
WV(i) ← interweave(MUL(i))

WV(i)	Value
WV(0)	04 49
WV(1)	16 00
WV(2)	16 49
WV(3)	04 04
WV(4)	25 81

Step 3: Find the square root of the interweaved values
ST(i) ← SQRT(WV(i))

ST(i)	Value
ST(0)	27
ST (1)	40
ST (2)	47
ST (3)	22
SV(4)	59

Step 4: Subtract the square root values with the key generated PT(i) ← SUB(ST(i))

PT(i)	Value	Key
PT(0)	25	2
PT(1)	37	3
PT(2)	42	5
PT(3)	15	7
PT(4)	57	2

Step 5: The subtracted value will be the plain text
Plaintext ← PT(i)

25 37 42 15 57

VIII. CONCLUSION

This paper has proposed a technique to ensure data security in internet of things based on data obfuscation technique namely ARO_EDGE. According to the proposed technique, the data are obfuscated before they are communicated among devices or local gateway. This technique obfuscates numerical values of the sensor data collected from the healthcare IoT devices. It uses different mathematical function to operate the original text into unintelligible text. The proposed technique reduces the size of the plaintext and ensures the confidentiality of the sensor data at the edge level.

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REFERENCES

[1] Maire O'Neill, "Insecurity by Design: Today's IoT Device Security Problem", Elsevier, 2016, Vol. 2, Iss. 1, pp. 48 & 49.

[2] A.Vithya Vijayalakshmi and Dr. L. Arockiam, "A Study on Security Issues and Challenges in IoT", International Journal of Engineering Sciences & Management Research, 2016, ISSN 2349-6193, Vol. 3, Iss. 11, pp. 1-9.

[3] Saurabh Sing and Pradip Sharma, Advanced lightweight encryption algorithms for IoT devices: survey, challenges and solutions", Journal of Ambient Intelligence and Humanized Computing, 2017, Springer, pp. 1-18, DOI: 10.1007/s12652-017-0494-4.

[4] Lobna Yehia, Ayman Khedr and Ashraf Darwish, "Hybrid Security Techniques for Internet of Things Healthcare Applications", Advances in Internet of Things, 2015, Vol. 5, pp. 21-25.

[5] Amirhossein Safi, "Improving the Security of Internet of Things using Encryption Algorithms", International Journal of Computer and Information Engineering, 2017, Vol. 11, No. 5, pp. 540-543.

[6] Salvador Perez, Jose, Hernández-ramos, Sara N. Matheu-garcía, Domenico Rotondi, Antonio F. Skarmeta, Leonardo Straniero, and Diego Pedone, "A lightweight and flexible encryption scheme to protect sensitive data in Smart Building scenarios", IEEE, 2016, Vol. 4, pp. 8956 – 8977, DOI: 10.1109/ACCESS.2017.2695525.

[7] Zhen-Yu Hong, Zhong-Pan Qiu, Si-Liang Zeng, Shui-De Wang and Mukase Sandrine, "Research on Fusion Encryption Algorithm for Internet of Things Monitoring Equipment", IEEE, International

Conference on Frontier of Computer Science and Technology, 2017, ISSN: 2375-527X, pp. 425-429.

[8] Vermesan, O. and Friess, P. “Internet of Things Applications - From Research and Innovation to Market Deployment”, 2014 (River Publishers Series in Communications).

[9] Kashif Saleem, Abdelouahid Derhab, Jalal Al-Muhtadi and Basit Shahzad, “Human-oriented design of secure Machine-to-Machine communication system for e-Healthcare society”, Elsevier, Computers in Human Behavior, 2014, Vol. 54, pp. 977-985.

[10] Dharmendra Singh Rajput and Rakesh Gour, “An IoT Framework for Healthcare Monitoring Systems”, International Journal of Computer Science and Information Security, 2016, ISSN 1947-5500. Vol. 14 No. 5, pp. 1-5.