Cloud-Assisted Privacy Preserving Authentication Scheme for Telecare Medical Information Systems

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OUTLINE





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Introduction

- The advancement in technology have made the internet an efficient to utilize for various remote services such as as e-banking, e-rail, e-health etc.
- Telecare Medical Information System(TMIS) one such online service provides facilities to the patient in which both telecare server and patient communicate with each other.
- The innovation of cheaper and robust telecommunication methods makes TMIS a convenient and effortless system.

Introduction (Cont.)

- TMIS helps to reduce proximity between the patient and healthcare systems using the existing network connections.
- However, these network connections might be insecure and prone to various attacks.
- To ensure the authorized and secure communication, user and server should verify each other.

Introduction (Cont.)

- Knowledge factors: e.g. Passwords, PIN numbers
- Possession factors: e.g. Smart cards, Security tokens
- Inherence factors: Biometric, e.g. iris scan, fingerprint, palm print

Introduction (Cont.)

Smart Card

- A smart card is a pocket sized plastic card with an embedded computer chip.
- The chip can either be a microprocessor with internal memory or a memory chip with non-programmable logic.
- They can be programmed to accept, store and send data.

Biometric

- Biometric based scheme has many advantages such as difficult to forget, guess, share, distribute, etc. over password, and smart card based schemes.
- So, the biometric based scheme is more reliable than the password and smart card based schemes.

Related Work

Year	Author	Description
2012	Padhy et al.[1]	Suggested a cloud-based healthcare information system model for rural healthcare center.
2014	Chen <i>et al.</i> [2]	Introduced a cloud-based medical data exchange protocol to solve the privacy preservation issues.
2016	Chiou et al. [3]	Enhanced the Chen et al.'s scheme pointed that the scheme fails to provide user anonymity and message authentication.
2017	Mohit <i>et al.</i> [4]	Chiou et al. et al.'s scheme could not withstand stolen mobile device attack and it fails to achieve patient anonymity.
2018	Li <i>et al.</i> [5]	Li et al. pointed that Mohit et al.'s scheme insecure against report revelation and report forgery attacks. Also, could not provide patient anonymity and patient unlinkability

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The Proposed Scheme

- To overcome the limitations, we have proposed privacy-preserving authentication scheme for TMIS.
- The scheme can achieve patient anonymity as well as resistant to several passive and active attacks.
- We assume that there are four communicating parties.
- The proposed scheme consists of five phases.
 - Registration phase
 - Healthcare center data upload phase (HUP)
 - Patient data upload phase (PUP)
 - Treatment phase (TP)
 - Checkup phase (CP)

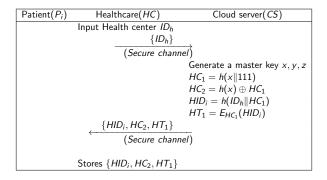
Notations Used

Table 1: Notations used

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Notation	Description
HC	Health care center
P _i	i th Patient
Di	i th Doctor
CS	Cloud server
ID _h	Health care center Identity
ID _p	Patient Identity
ID_d	Doctor Identity
Data _h	Health care center inspection report
Datap	Patient inspection report
Datad	Doctor inspection report
A _v	Adversary
x, y, z	Master key of cloud CS
$h(\cdot)$	One way hash function
\oplus	Bitwise XOR operator
	Concatenation operation

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Registration of HC with Cloud Server



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Performance Evaluation

Table 2: Computational and Communicational Cost Analysis of Scheme

Scheme	Chiou et al. [3]	Mohit <i>et al.</i> [4]	Li et al. [5]	Proposed scheme	
Registration phase	-	_	_	$7T_{HS}+5T_{EM}$	
HUP	$1T_{Sig} + 3T_{BP} + 2T_{EM} + 7T_{HS}$	$1T_{Sig} + 3T_{EM} + 11T_{HS}$	$1 T_{Sig} + 3 T_{EM} + 11 T_{HS}$	$11T_{HS}+2T_{EM}$	
PUP	$1T_{Sig} + 4T_{BP} + 2T_{EM} + 12T_{HS}$	$2T_{Sig} + 2T_{EM} + 10T_{HS}$	$2 T_{Sig} + 4 T_{EM} + 10 T_{HS}$	$9T_{HS}+2T_{EM}$	
TP	$2T_{Sig} + 4T_{BP} + 4T_{EM} + 7T_{HS} + 4T_{MUL}$	$2T_{Sig} + 3T_{EM} + 9T_{HS}$	$3T_{Sig} + 6T_{EM} + 10T_{HS}$	8 <i>T_{HS}</i> +4 <i>T_{EM}</i>	
CP	$1T_{Sig} + 2T_{BP} + 2T_{EM} + 8T_{HS}$	$1T_{Sig} + 2T_{EM} + 5T_{HS}$	$1 T_{Sig} + 2 T_{EM} + 6 T_{HS}$	6 <i>T_{HS}</i> +2 <i>T_{EM}</i>	
Total cost	$5T_{Sig} + 13T_{BP} + 10T_{EM} +$ $33T_{HS} + 4T_{MUL}$	$6T_{Sig} + 9T_{EM} + 35T_{HS}$	$7T_{Sig} + 15T_{EM} + 37T_{HS}$	41 <i>T_{HS}</i> +15 <i>T_{EM}</i>	
Total Time	2.7705s	2.086s	2.4709s	0.1495s	
Communicational Cost	5280 bits	5120 bits	3680 bits	3648 bits	

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Performance Evaluation

Table 3: Security Comparison of Schemes

Scheme	A1	A2	A3	A4	A5	A6
Chiou <i>et al.</i> [3]	×	×	\checkmark	\checkmark	×	\checkmark
Mohit <i>et al.</i> [4]	×	×	\checkmark	×	×	~
Li <i>et al.</i> [5]	\checkmark	×	\checkmark	\checkmark	\checkmark	\checkmark
Proposed scheme	\checkmark	\checkmark	\checkmark	~	\checkmark	\checkmark

A1-Patient Anonymity A2-Known-key security, A3-Report confidentiality, A4-Resistance to report forgery attack, A_5 -Patient unlinkability, A6-Mutual Authentication \checkmark - Prevent Attack, \times - Attack not prevented.

Conclusion

- We have presented a privacy preservation authentication scheme for TMIS using cloud which achieves patient anonymity even though all the participants can send their data through an insecure channel.
- The proposed scheme is lightweight as we have used hash functions in various phases.
- The scheme is cost effective in terms of computational and communicational cost.
- Due to its low computational cost on the patient's side, a resource constraint device such as mobile is used.

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