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# To Innovate Wireless Security Protocols' Improvement: Inventive Principles, Guidelines and Potential Recommendations

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***Abstract:***

The research documents importance of widespread wireless networks. With increase in wireless networks usage, security concerns in wireless networks are becoming more serious. This article sheds light on existing deficiencies in techniques and protocols of wireless networks' security. Considering the deficient factors and to seek possible future improvements, the research presented potential usage of Theory of Inventive Problem Solving (TRIZ) in field of wireless network security. It derives set of guidelines from TRIZ knowledgebase to provide conceptual thinking support for solution hunters in field of wireless network security. The proposed conception of deriving innovative guidelines from TRIZ knowledgebase provides a novel way to implement TRIZ in network security field.

## Introduction

With the increase in wireless networks usage, security over wireless networks has been a major concern and topic of research. A lot of work over this topic can be referred from research literature in recent years. Different security protocols including major standards of WEP, WPA and WPA2 are being deployed and tested along with other scenario specific protocols to achieve fool proof security. So far the researchers in the field of wireless networks security have been struggling to achieve technologies which answer all concerns as one in all solution. A lot has been done and still a lot has to be done to cater all existing problems [1-7]. With continuous developments to protect crucial data on networks, systems and technologies have become more complex and elusive. To reach some further improvement in such scenario is a difficult and complex task. The already mature developed technologies need some breakthrough and innovative solutions to win higher share in the market of tight competition. This research proposed potential usage of 'Theory of Inventive Problem Solving (TRIZ)' in field of wireless network security to achieve some breakthrough improvements in existing technologies [8-10].

TRIZ is a Russian language acronym for "Theory of Inventive Problem Solving". It was initially worked out and introduced by Genrikh Altshuller and his companion researchers in 1946. TRIZ has been documented in research literature widely for its conception of inventive principles and breaking contradictions to achieve breakthrough solutions. Mainly emerging as engineering solutions methodology, it has been spear to different fields like technology management, applied sciences and even social sciences [8-10]. This research proposed development of sector specific guidelines for seeking improvement in wireless networks security technologies/protocols. Considering few of the known deficiencies discussed in research literature, the research develops a set of inventive principles and future trends from TRIZ knowledgebase to help researchers working to cater those deficiencies. The recommendations and innovation principles are derived from patents' database and are so called rules of systematic invention as per conception of TRIZ.

## Research approach and Methodology:

To present a test case for how to derive a set of guidelines for improvement of network security protocols, the research derived key parameters related to deficiencies pertaining to technologies under question. Those parameters were then mapped to TRIZ terminologies to relate with TRIZ database. Related TRIZ parameters are derived for deducing the inventive principles and recommendations for potential gaps, future transitions and improvements in security protocols used for wireless networks security. **Fig 1** displays the methodology adopted in summarized form:

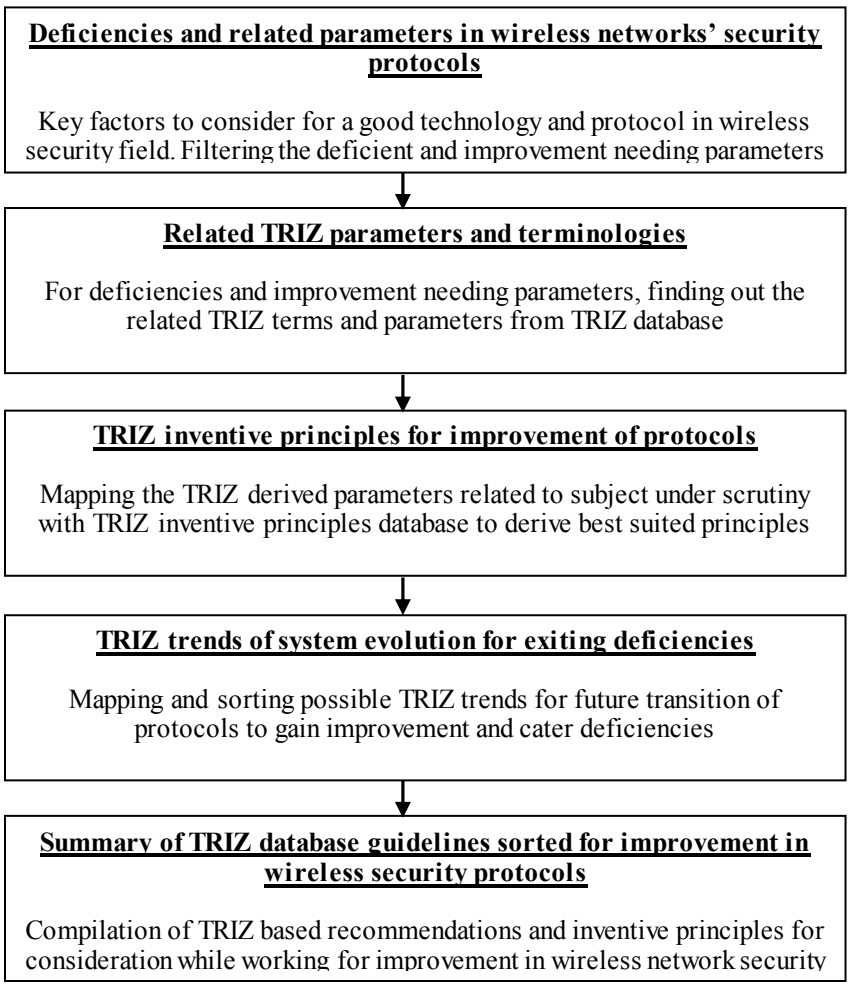


**Fig 1:** Stepwise guidelines generation process for wireless network security protocols

Following the above mentioned steps, the research conducted a test case for few of the parameters to show how to derive proposed guidelines. The derived guidelines will provide a conceptual foundation of possible solutions and directions towards possible solutions and hence will support thinking process of solution hunters. This support based on innovation principles follows the route of TRIZ methodology conceptions which can be summarized as **Fig 2:**

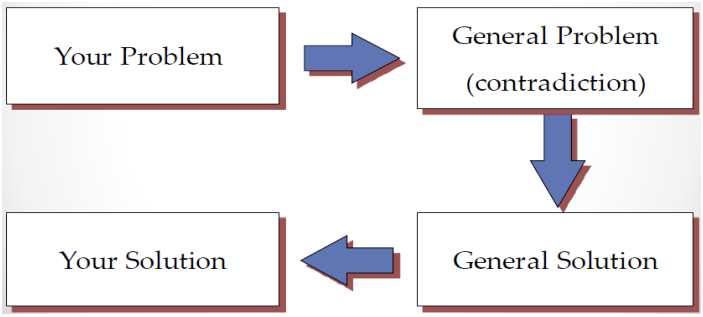


Fig 2: TRIZ overall approach for problem solving

**Wireless network security protocols' improvement and TRIZ:**

A comparison [11] conducted for the renowned techniques and algorithms in field of wireless networks security si referred for this research. The said research [11] made a strong comparison on different techniques and algorithms for multiples parameters including data blocks, type of data, power consumed, transmission of data and finally the encryption and decryption time. The core parameters discussed and highlighted by the research show time of processing and battery power consumption among top priorities. Among the other efficiency parameters, battery power consumption and processing time are crucial for portable smart wireless devices used by wireless users. To show possible implementation of TRIZ innovative principles and generic innovation rules from TRIZ patent's knowledgebase, this research derives a set of key principles and recommendations for improving power consumption of some security algorithm in future. As a pilot case, it derives related inventive principles and recommendations pertinent to few of wireless network security issues from TRIZ knowledgebase. The derived set of principles and recommendations will work as framework to guide towards future improvements in wireless network security protocols.
Considering improving parameters of processing time and battery power consumption, the derived TRIZ inventive principles and recommendations from different TRIZ tools and methods are compiled in **Table 1** and **Table** 2 [12-17].

**Table 1:** TRIZ parameters and related inventive principles in decreasing order of priority/frequency

| **Key parameters related to time and power** | **Inventive principles most likely to be considered** |
|---|---|
| Size (dynamic) | 35, 10, 24, 3, 2, 15, 25, 4, 13, 7, 37, 5 |
| Loss of time | 10, 35, 3, 25, 13, 37, 4, 2, 7, 1, 24, 5, 19 |
| Security | 13, 2, 4, 3, 37, 15, 17, 24, 10, 1, 19, 25 |
| System complexity | 25, 10, 13, 2, 3, 24, 19, 7, 37, 15, 35, 1 |
| Ability to detect/measure | 35, 37, 10, 28, 3, 13, 7, 15, 1, 24, 4, 19, 2 |
| Amount of data | 10, 3, 25, 24, 13, 2, 17, 4, 19, 37, 5, 15 |
| Speed | 10, 13, 3, 24, 17, 35, 4, 2, 5, 37, 19, 25 |

**Table 2:** List of related principles and their names from TRIZ knowledgebase

| **TRIZ Principle No.** | **Principle No.** | **Principle** |
|---|---|---|
| Pr 1 | Segment | Divide subject or system into separate parts |
| Pr 2 | Take out/ separation | At some specific conditions the system may not require certain functions. Design system the way it may get separate in those conditions |
| Pr 3 | Local Quality | Where a system is homogeneous, make it non-uniform or vice-versa |
| Pr 4 | Asymmetry | When a system or object is symmetrical or have the |

| | | |
|---|---|---|
| | | lines of symmetry, asymmetries may be introduced |
| Pr 5 | Merging | Join together or combine objects or operations or may be the functions (may act together in space or time) |
| Pr 7 | Nesting | Place one object or the system inside the other one |
| Pr 10 | Prior action | Introduce or arrange an action before it is needed in a system or object |
| Pr 13 | Other way around | Use an opposite action/turn system or process upside down |
| Pr 15 | Dynamization | Allow a system or object to change to achieve optimum conditions/make it flexible |
| Pr 17 | Another dimension | Transition from one dimension to two or from two to three dimensions |
| Pr 19 | Periodic action | Change continuous action to periodic action. If the action is periodic already, may change its magnitude or frequency |
| Pr 24 | Intermediary | Introduce an intermediary between objects, system or actions. It can be a temporary intermediary which removes after performing action |
| Pr 25 | Self service | Make itself serving with auxiliary functions or making use of energy/substance |
| Pr 28 | Another sense/fields | Replace the existing means with another different means/medium |
| Pr 35 | Parameter changes | Change parameters within system, until a step change is triggered in response. Change parameters around the system like chaging OS or upgrading etc. |
| Pr 37 | Relative change | Make use of phenomena taking place during different paradigm shifts |

The possibly related trends of system evolution for wireless network security protocols' improvement and possible future transition reasons from TRIZ knowledgebase are sorted in Table 3 [12-17].

**Table 3 :** Recommendations from TRIZ trends for chosen parameters improvement

| **TRIZ sub-trend** | **Reasons and potential gaps** |
|---|---|
| Segmentation | Improved code clarity<br>Reduced size of the system<br>Improved system efficiency<br>Response to individual/local conditions |
| Nesting (size and time) | Increasing system flexibility<br>Increasing time efficiency<br>Improved response rate<br>Improved inter-system coordination |

| | |
|---|---|
| Mono-Bi-Poly | Increased system functionality<br>Increased system operability<br>Reduced number of systems<br>Reduced net system size |
| Connections (fixed=>discrete=>continuous switchable) | Increased flexibility<br>Increased speed/efficiency<br>Improved system robustness<br>Improved multi-tasking<br>Improved system learning capability |
| Design point | Improved performance at all operating conditions<br>Improved system efficiency<br>Reduced energy loss<br>Broader operating range |
| Feedback and control | Improved user safety<br>Improved system efficiency<br>Reduced likelihood of error<br>Ability to control function delivery<br>Improved user-proofing<br>Improved dynamic performance<br>Improved self learning and repairing systems |
| Process thinking | Reduced time/cost/risk<br>Higher quality results<br>Improved communications/response<br>Improved portfolio management<br>Improved change management |
| Action coordination | Reduced time wastage<br>Increased system efficiency<br>Improved safety<br>Increased user convenience<br>Less likelihood of system damage |
| Reducing system complexity | Reduced complexity<br>Reduced development and maintenance cost<br>Improved reliability |

These derived set of inventive principles and recommendations of possible transitions in security protocol's improvement can provide conceptual guidance for possible improvements in future. Using these inventive principles and potential transitional gaps as guidelines, the developers may find better version of network security protocols.

**Summary:**

The document discussed importance of wireless security and the existing protocols for the wireless network security in today's grooming wireless markets. Referring to research literature it consulted researches which compared different available protocols and techniques, which are being used for counter the network security issues. Then it referred the potential gaps still persist in existing technologies/protocols and can be addressed for future improvement. Relating the possible future gaps and deficiencies in existing techniques, the research provided a potential

application of 'Theory of Inventive Problem Solving (TRIZ)' in field of network security. To help the developers in field of wireless network security, the research derived a set of most related parameters, related invented principles (derived originally from patent's database), TRIZ evolution trends for network security protocols and provided the potential benefits by attaining the proposed transitions in existing techniques/protocols/systems.

**References:**


[1] Nicholas R. and Lekkas P., "Wireless Security: Models Threats and Solutions". McGraw-Hill Publications, 2002.

[2] ISS, "Wireless LAN Security", An ISS Technical White paper, www.iss.net/documents/whitepapers/wireless_LAN_security.pdf, 2001.

[3] Wang L. and Srinivasan, B., "Analysis and Improvements over DoS Attacks against IEEE 802.11i Standard", Second International Conference on Networks Security Wireless Communications and Trusted Computing (NSWCTC) , Vol. 2, No. 109, pp. 24-25, 2010.

[4] Wi-Fi Alliance "Wi-Fi Protected Access: Strong Standards based Interoperability security for today's Wi-Fi networks" Wi-Fi Alliance, April 2003.

[5] Barret J. "Wireless LAN security Policy Template", Cisco Systems http://www.cwnp.com/templates/WLAN_Security_Policy_Template_v1.05.pdf, 2003.

[6] Kempf J., "Wireless Internet Security: Architecture and Protocols," Cambridge" University Press, 2003.

[7] Saleh. M. A.,"Weakness of Authentication and Encryption Methods Used in IEEE802.11b/g Wireless Networks ", IEEE Alexandria student Branch, 2006.

[8] Webb. "TRIZ: An Inventive Approach to Invention.", Engg. Management Journal Vol. 12, pp. 117−124, 2012.

[9] Mann D., "Hands on Systematic Innovation", CREAX Press, Belgium, 2002.

[10] Mansoor M., "Towards A Model/Framework for Optimizing Automated Engineering Systems in Developing Countries", The annual conference of the Altshuller Institute TRIZCON, Kent State University, Ohio USA, 2008.

[11] Salama H., Kader A., and Hadhoud M., "Wireless Network Security Still has no Clothes", International Arab Journal of e-Technology, Vol. 2, No. 2, pp. 112-123, 2011.

[12] Mann, D., "Systematic (Software) Innovation", IFR Press, UK, 2008.

[13] Ikenokov S., "MyTRIZ Workshop Handout Notes", In MyTRIZ Workshop, UniTen, Malaysia, Nov 2011.

[14] San Y. T., "TRIZ Level-2 Workshop Handout Notes", TRIZ Level-2 Workshop, KDU, Malaysia, 2012.

[15] Mansoor M., Mariun N., Ismail N., Abdul Wahab I. N., "A Guidance Chart for Most Probable Solution Directions in Sustainable Energy Developments", Renewable and Sustainable Energy Reviews. Vol. 24, pp. 306–313, 2012.

[16] Xiaohui Y., "To Facilitate Knowledge Management Using Basic Principles of Knowledge Engineering", Proceedings of Pacific-Asia Conference on Knowledge Engineering and Software Engineering , Shenzhen, China, 19-20 Dec, pp. 94-97, 2009.

[17] Mansoor M., Mariun N., Ismail N., Abdul Wahab I. N., "Towards Knowledge Engineering Based Guidance for Electrical Engineers" Przeglad Elektrotechniczny (Electrical Review) Vol. 88, No.11a, pp. 363-365, 2012.