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## ON-DEMAND CLOUD MIND-MAPPING AS AN INNOVATION FRAMEWORK IN BIOMETRIC SYSTEMS DEVELOPMENT LIFE CYCLE

**Summary.** The paper presents the possibilities of computer-aided mind mapping for the creation of a platform of innovation in initial stage of the life cycle of biometric systems. In the first part of the article we present mind map method and information tools to exploit the potential of distributed processing in the implementation of on-demand platform innovation biometric system. In the second part of the article we present the results in terms of implementation and operation of the experimental platform for the development of innovation biometric system that uses dynamic typing.

**Keywords:** biometric system, mind maps, life cycle.

## WYKORZYSTANIE KOMPUTEROWEJ IMPLEMENTACJI METODY MAPY MYŚLI W MODELU SAAS JAKO PLATFORMY ROZWOJU INNOWACJI W INICJALNEJ FAZIE CYKLU ŻYCIA SYSTEMÓW BIOMETRYCZNYCH

**Summary.** W artykule przedstawiono możliwości komputerowo wspomaganego mapowania myśli dla potrzeb utworzenia platformy rozwoju innowacji w inicjalnej fazie cyklu życia systemów biometrycznych. W pierwszej części artykułu przedstawiono metodę mapy myśli oraz informatyczne narzędzia, pozwalające na wykorzystanie potencjału przetwarzania rozproszonego w realizacji dostępnej na żądanie platformy rozwoju innowacji systemu biometrycznego. W drugiej części artykułu zaprezentowano rezultaty w zakresie implementacji oraz eksploatacji eksperymentalnej platformy rozwoju innowacji systemu biometrycznego, wykorzystującego dynamikę pisania na klawiaturze.

**Słowa kluczowe:** system biometryczny, mapy myśli, cykl życia.

## 1. Introduction

Development of innovation in current security solutions is inevitable in order to address current threats as well as zero-day attacks. According to the literature [3] there are ten key security domains and within the second domain, the biometric systems [1, 4] used for identification and authentication are classified:

- 1: Information Security and Risk Management.
- 2: Access control.
- 3: Application Security.
- 4: Business Continuity and Disaster Recovery Planning.
- 5: Cryptography.
- 6: Laws, Regulations.
- 7: Operations Security.
- 8: Physical and Environmental Security.
- 9: Security Architecture.
- 10: Network Security.

In this article we discuss the development the possibilities of computer-aided mind mapping for the creation of a platform of innovation in initial stage of the life cycle of biometric systems. In the first part of the article we present mind map method and information tools to exploit the potential of distributed processing in the implementation of on-demand platform innovation biometric system. In the second part of the article we present the results in terms of implementation and operation of the experimental platform for the development of innovation biometric system that uses dynamic typing.

## 2. Methods and tools

Mind map as a concept of visualizing connections is applied in order to enable to create innovations in biometric systems design and planning, which is performed in initial stage of biometric system life cycle. Mind map shall be created ad hoc, using Software as a Service Approach and shall be edited by team members involved in biometric systems innovation creation.

For the purpose of this article, the cloud-based solutions were chosen (see fig. 1 and fig. 2). The first one, which enables creation of mind maps without synchronous AV collaboration (mind42.com), and the second one, which enables creation of mind maps with synchronous AV collaboration (webex.com). More details about chosen solutions can be found here [7, 8].

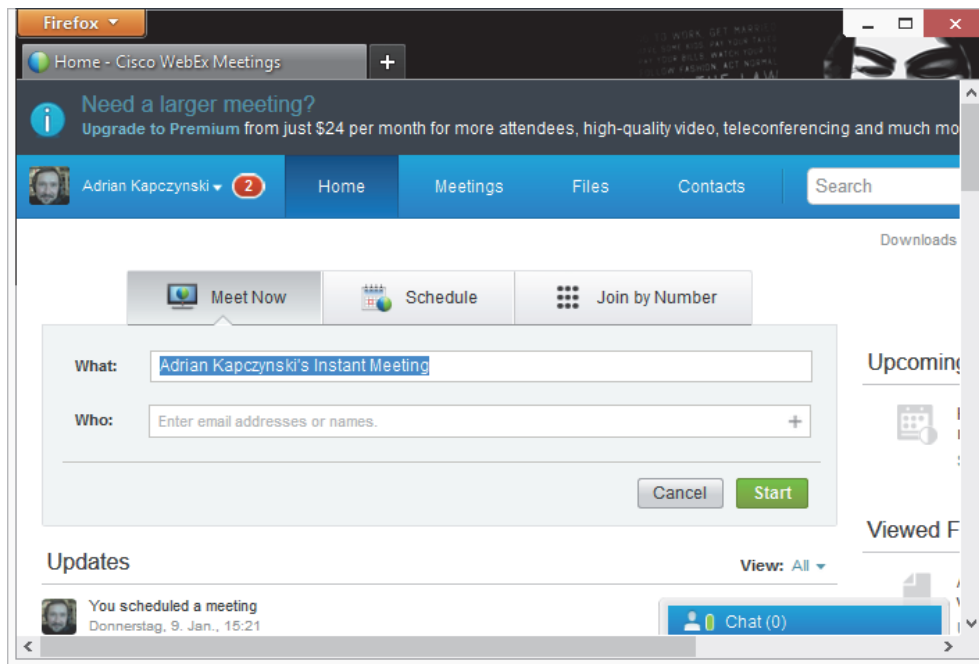


Fig. 1. Webex.com as cloud based mind mapping internet solution

Rys. 1. Webex.com jako internetowe środowisko mapowania myśli

Źródło: opracowanie własne.

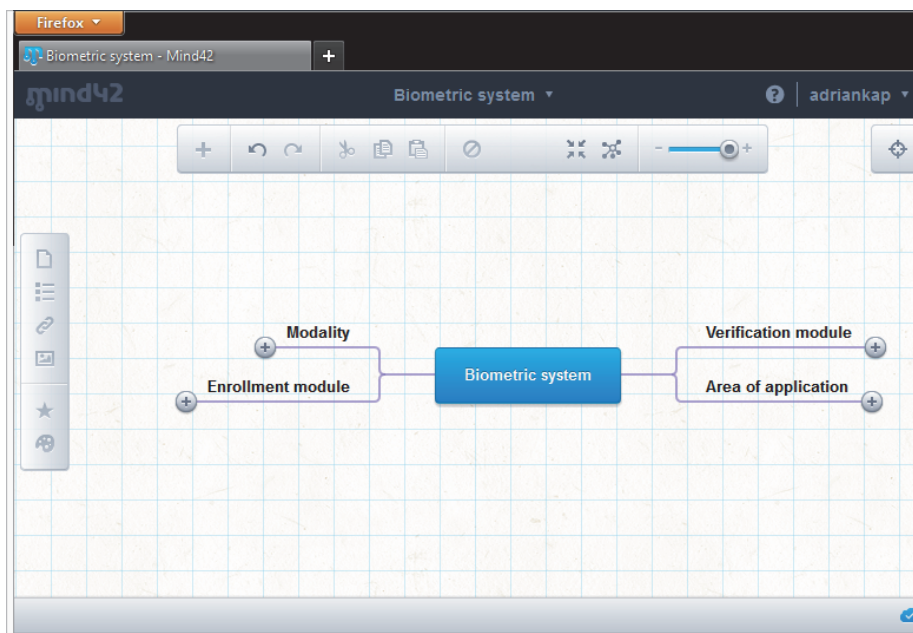


Fig. 2. Mind42.com as cloud based mind mapping internet solution

Rys. 2. Mind42.com jako internetowe środowisko mapowania myśli

Źródło: opracowanie własne.

### 3. Research results

The goal of the research was to formulate the innovation potential of biometric authentication system based on keystroke dynamics [2, 5]. Analyzing keystroke dynamics is a process that analyzes the way users type by monitoring the keyboard inputs and then identifies users on their individual typing rhythm patterns. While the user is typing a string key down and up times are captured to achieve features: duration of the key and keystroke latency. Duration of the key is the time interval between pressing and releasing the key and keystroke latency is the time between two generated keystrokes [6].

The research team consisted of 10 biometric experts specializing in: artificial intelligence, user experience (UX), software engineering, information security with special emphasis on strong authentication methods and systems, signal processing, keystroke dynamics, project management and software/hardware quality assurance.

The first phase, which was called the “Invention phase” was aimed at gathering innovative ideas from members of the research team and was conducted synchronously. During the first phase the Webex conferencing solution was used.

The second phase, which was called the “Consolidation phase”, was aimed at creation of integrated mind-map through the merge of partial ideas and was conducted asynchronously. During the second phase the Webex conferencing solution was used.

Mind map as a concept of visualizing connections was applied in order to enable to create innovations in keystroke dynamic biometric system design.

The created mind-map (fig. 3) showed innovations in protecting biometric systems:

- protecting biometric systems against sniffing biometric templates, by means of cryptography; encryption of header and payload,
- protecting biometric systems against replay-attacks by means of:
  - technological steganography, where each stored referenced biometric template has non-visible, steganographically embedded meta-data, describing the authenticity of template; therefore injections attacks can be detected,
  - detailed (frame-by-frame) comparative analysis of time frames of reference and verification biometric templates;
- protecting biometric systems from unauthorized core system function execution, through application RBAC-model as well as authentication before function call and exit data validation,
- protecting biometric systems from unauthorized system configuration analysis and modification, through hardening data at rest (configuration files) and data at motion (operational data).

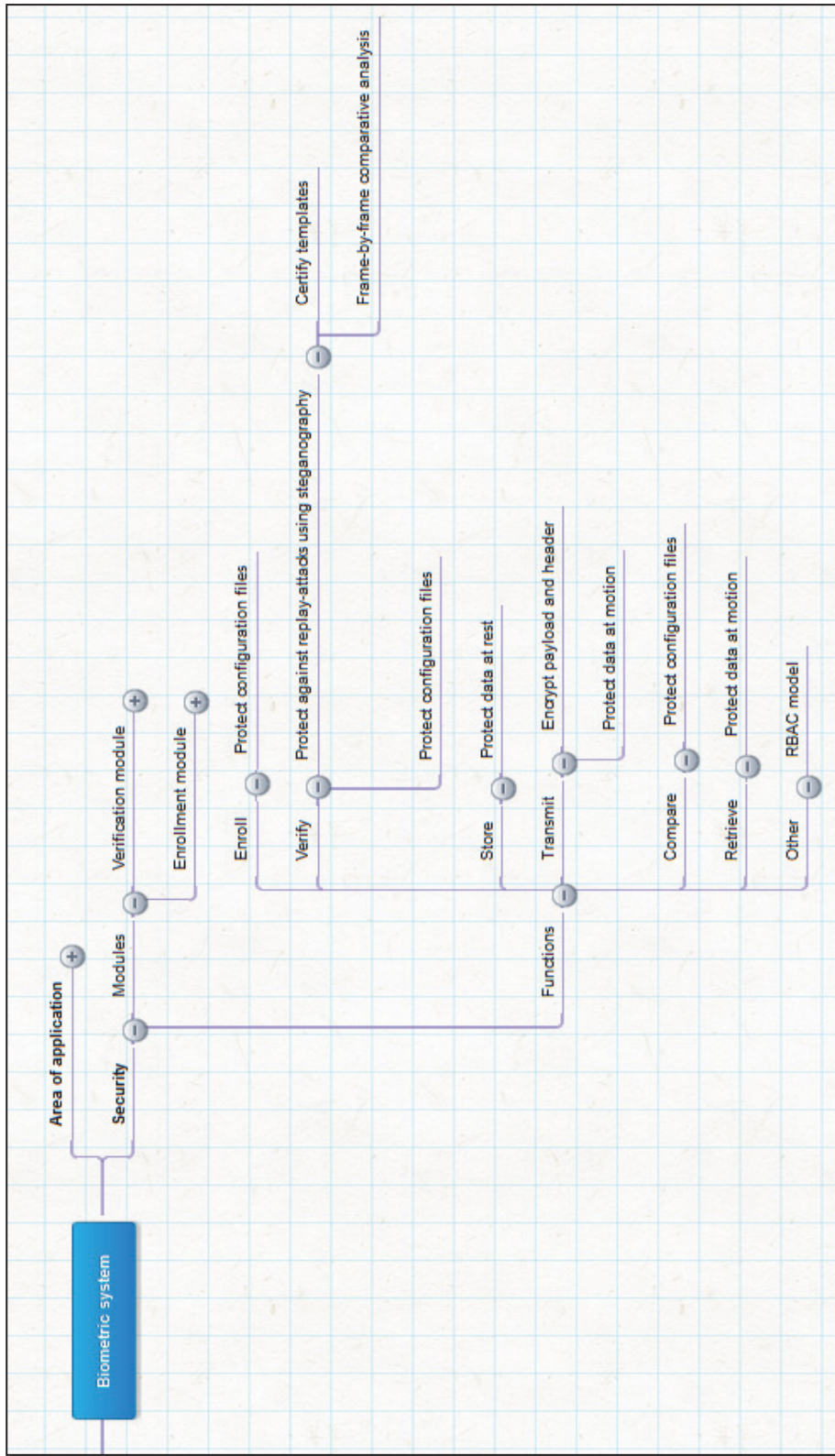


Fig. 3. Mind map created after second phase  
 Rys. 3. Mapa myśli utworzona po drugiej fazie  
 Źródło: opracowanie własne.

## 4. Conclusions

The results showed that cloud based mind-mapping is a successful approach to generate innovations in biometric systems initial phase of development. The practical implementation of both phases showed the strengths of chosen approach: productivity and flexibility.

The key findings in the field of biometric security were related to: protecting biometric systems against sniffing biometric templates, protecting biometric systems against replay-attacks, protecting biometric systems from unauthorized core system function execution and finally, protecting biometric systems from unauthorized system configuration modification.

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## Omówienie

W artykule przedstawiono możliwości komputerowo wspomaganego mapowania myśli dla potrzeb utworzenia platformy rozwoju innowacji w inicyjalnej fazie cyklu życia systemów biometrycznych.

W pierwszej części artykułu przedstawiono metodę mapy myśli oraz informatyczne narzędzia, pozwalające na wykorzystanie potencjału przetwarzania rozproszonego w realizacji dostępczej na żądanie platformy rozwoju innowacji systemu biometrycznego.

W drugiej części artykułu omówiono wyniki w zakresie implementacji oraz eksploatacji eksperymentalnej platformy rozwoju innowacji systemu biometrycznego, wykorzystującego dynamikę pisania na klawiaturze.