Implementation of Active Learning in the Master's Program on Cybersecurity

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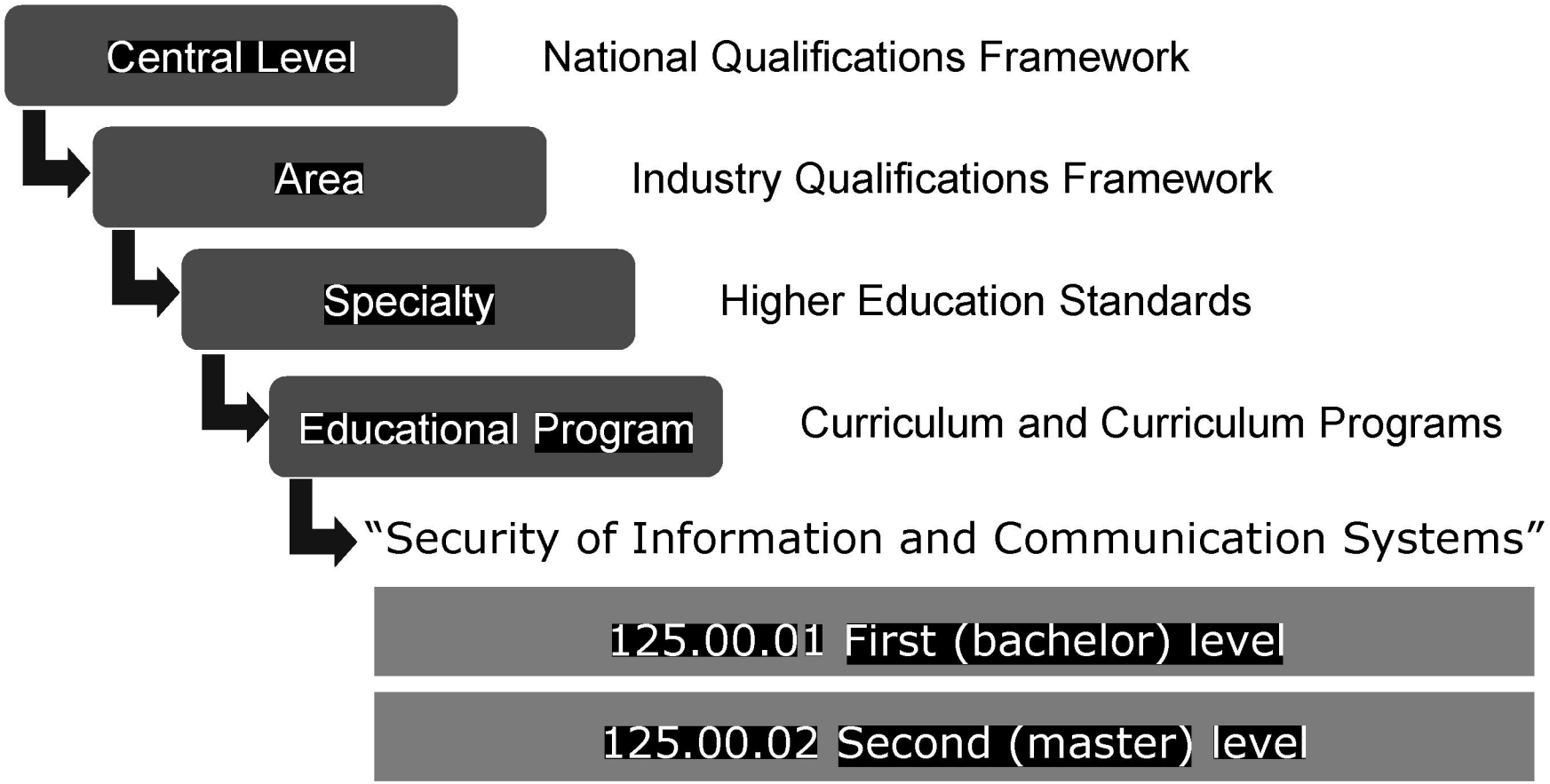
Modern Education and Computer Science PRESS

ICCSEEA2019

IClCS

Design of Learning Outcomes

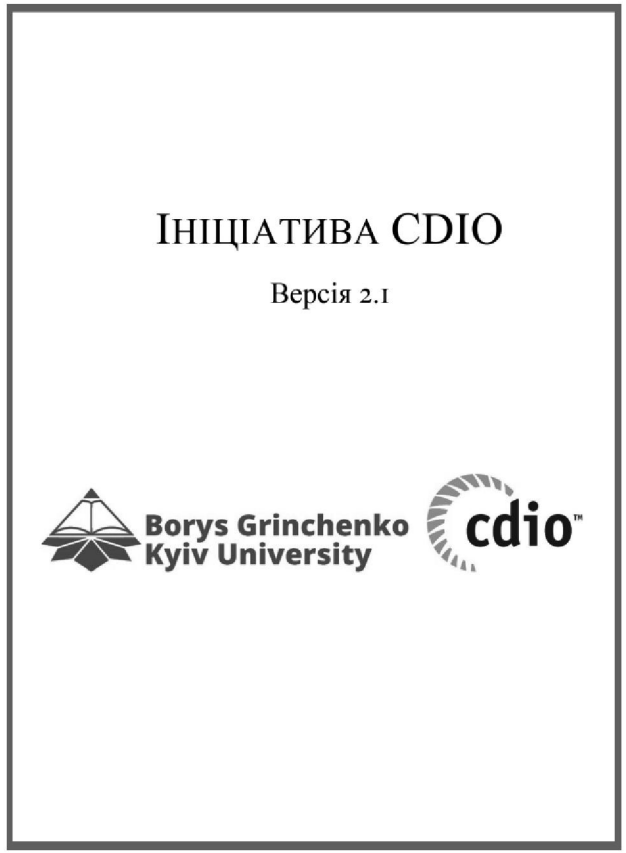


International Experience in Active Learning

- **C**onceiving
- **D**esigning
- **I**mplementing
- **O**perating

Translation into Ukrainian*:

Ініціатива CDIO / перекл. В. Ю. Соколов, ред. В. Л. Бурячок. — Версія 2.1. — К. : КУБГ, 2018. — 34 с.



* Original see http://www.cdio.org/content/cdio-standard-21

Main Approaches to Active Learning

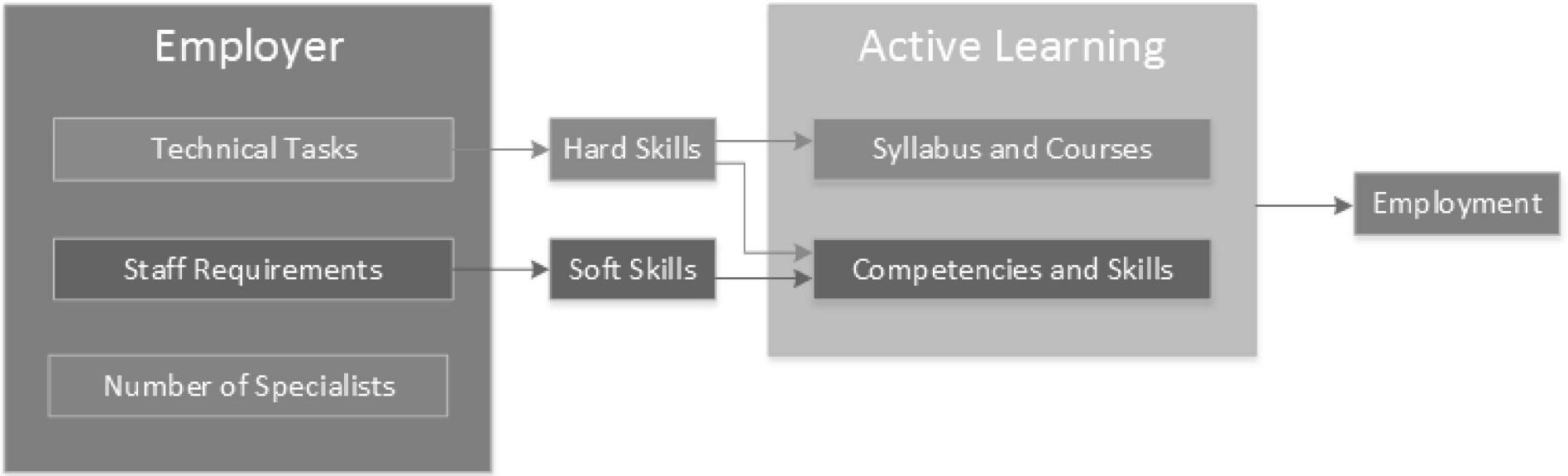
Individuality of the task:

- Due to a different set of skills and competencies of applicants
- Characterized by the need to select a topic according to the student's prior knowledge, skills and abilities

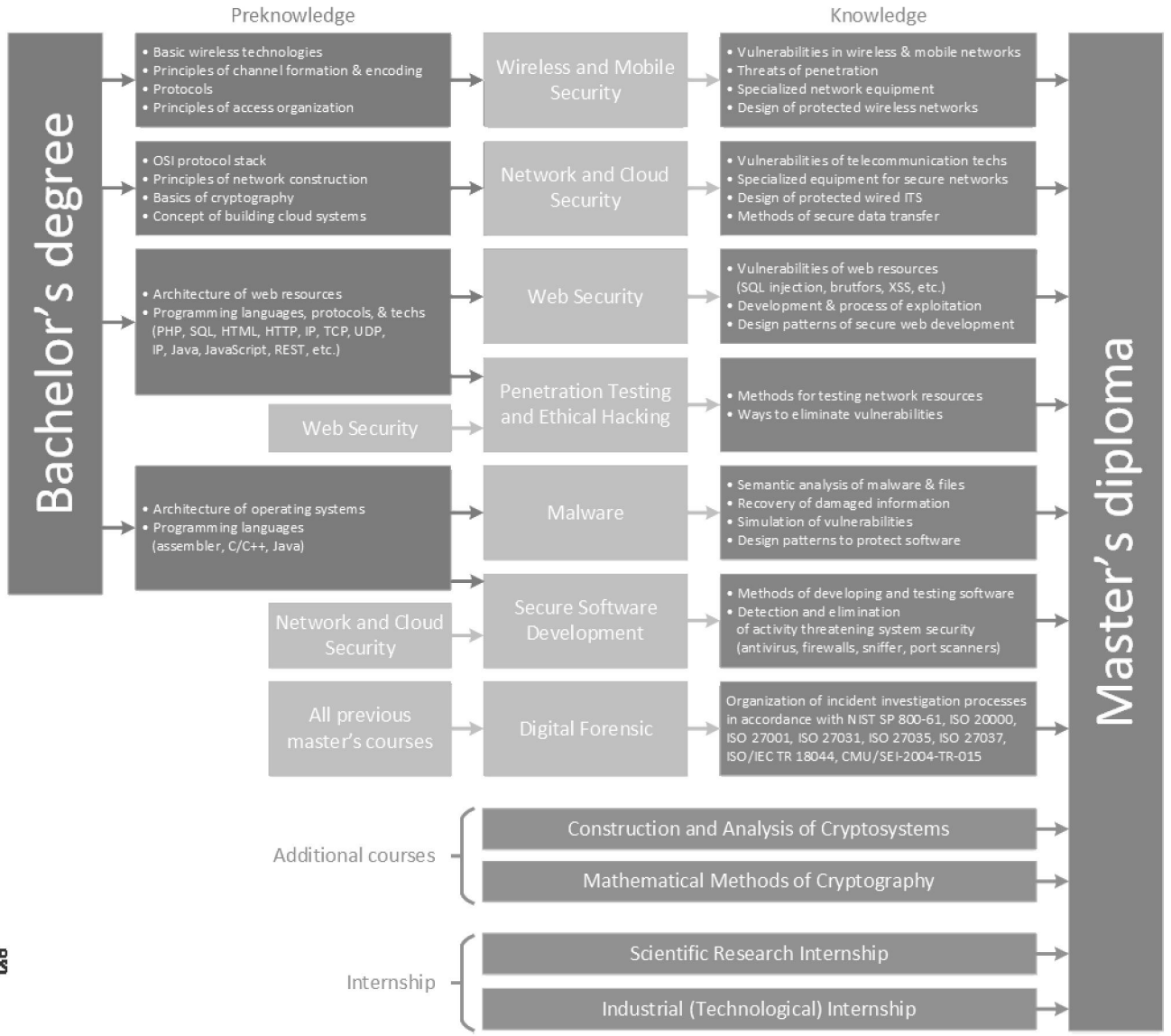
Focus on the result:

- Due to student interest in master's work
- Characterized by the need to develop experimental layouts, stands and systems
- The need to ensure transparency of the results of master's work

Master Skills and Curriculum Formation Scheme



Block Diagram of the Master's Program in "Cybersecurity"



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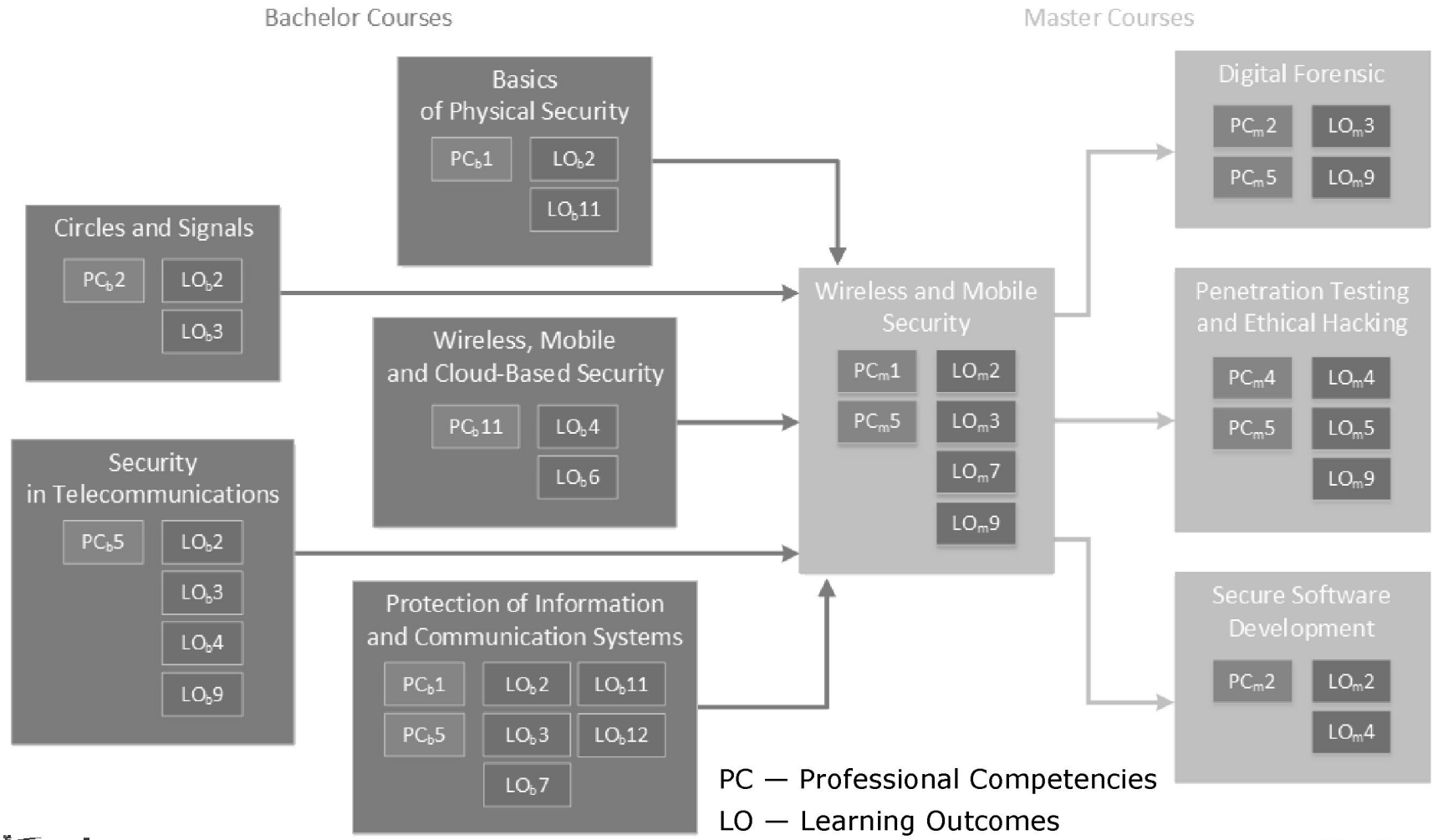
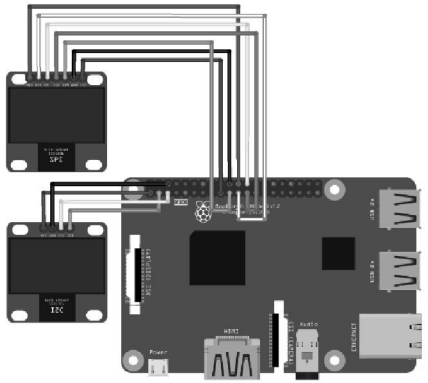
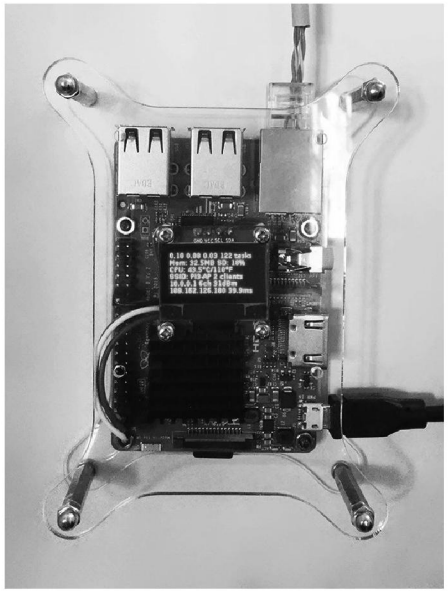
Continuity of Competencies for "Wireless and Mobile Security"

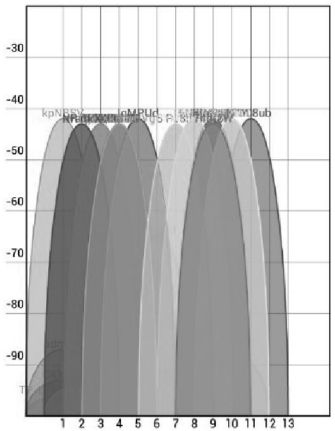


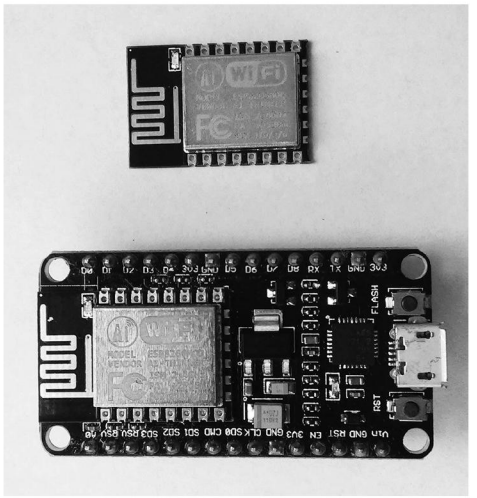
Active Learning in Wireless and Mobile Security Course





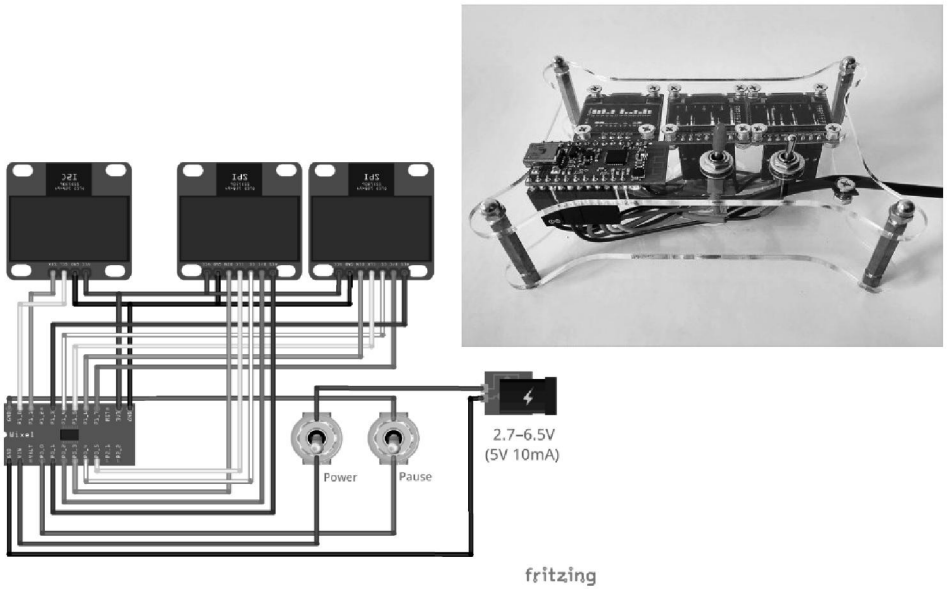
Research of load
of a wireless network



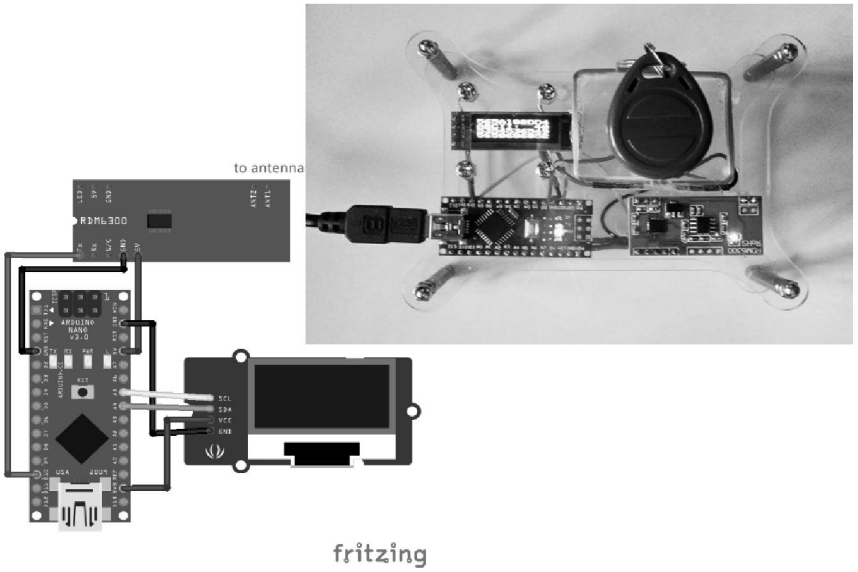


DoS attacks
on the Wi-Fi network

Active Learning in Wireless and Mobile Security Course



Radio frequency resource
Wi-Fi 2.4–2.5 GHz

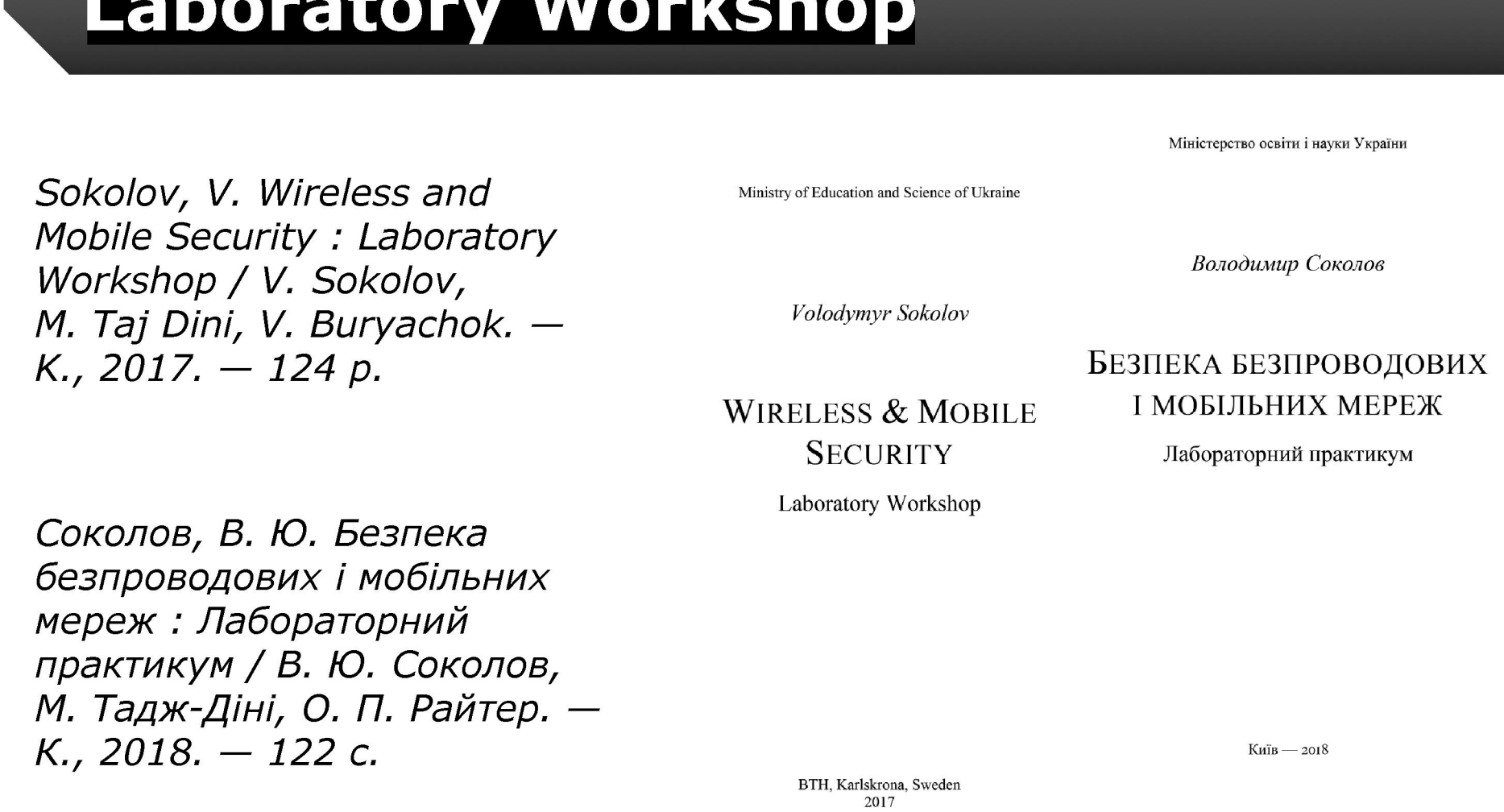


125 kHz RFID sniffing

Wireless and Mobile Security Laboratory Workshop

Sokolov, V. Wireless and Mobile Security : Laboratory Workshop / V. Sokolov, M. Taj Dini, V. Buryachok. — K., 2017. — 124 p.

Соколов, В. Ю. Безпека безпроводових і мобільних мереж : Лабораторний практикум / В. Ю. Соколов, М. Тадж-Діні, О. П. Райтер. — К., 2018. — 122 с.



Ministry of Education and Science of Ukraine

Volodymyr Sokolov

WIRELESS & MOBILE SECURITY

Laboratory Workshop

BTH, Karlskrona, Sweden
2017

Міністерство освіти і науки України

Володимир Соколов

БЕЗПЕКА БЕЗПРОВОДОВИХ І МОБІЛЬНИХ МЕРЕЖ

Лабораторний практикум

Київ — 2018

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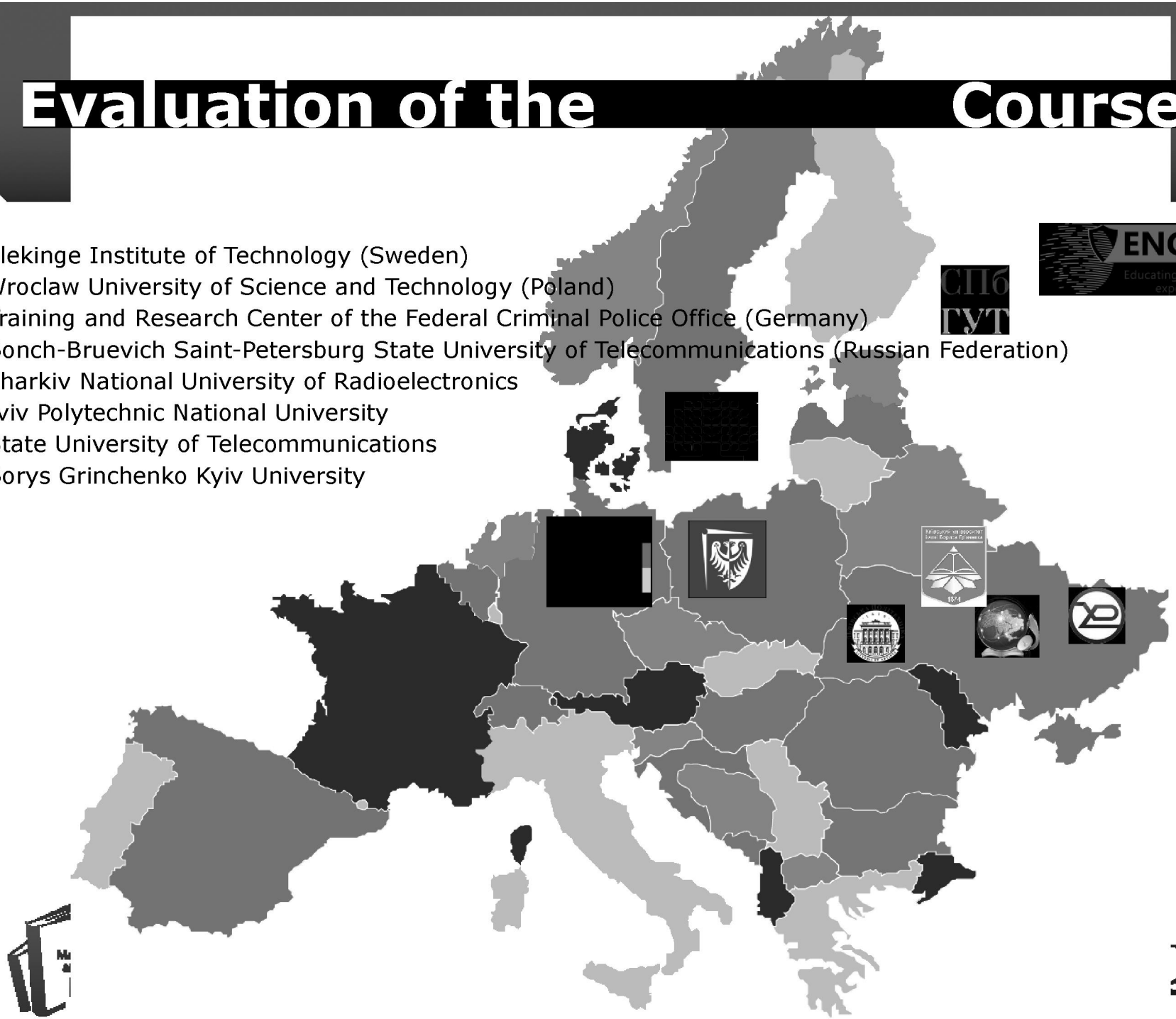
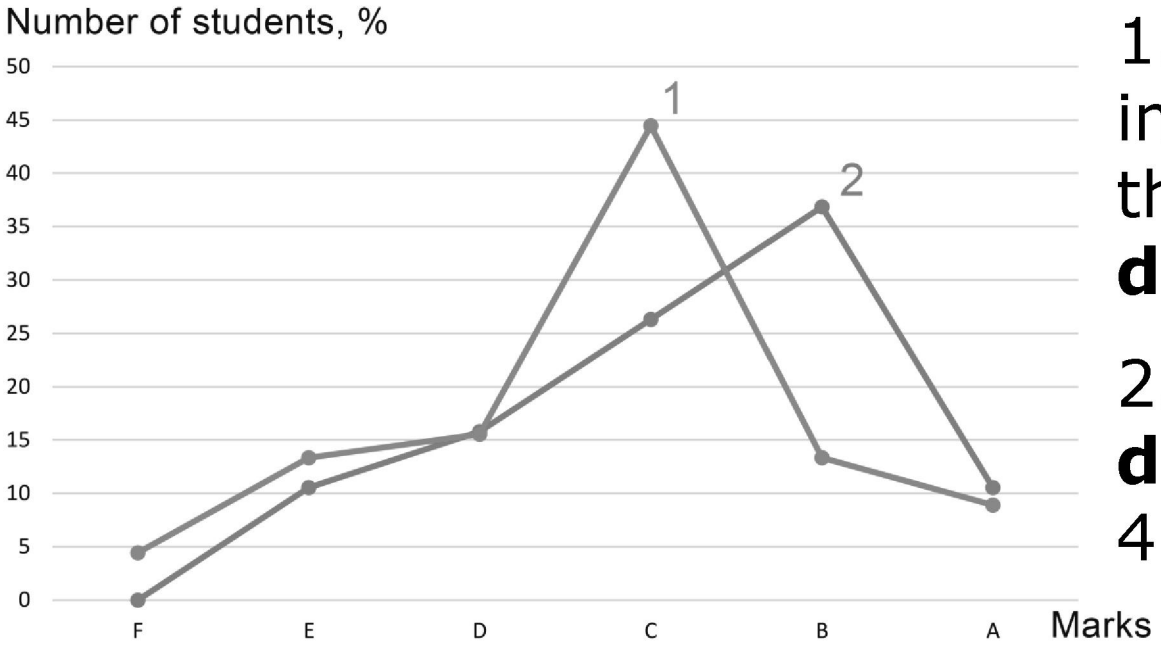
ICICS

Evaluation of the Course

Blekinge Institute of Technology (Sweden)
Wroclaw University of Science and Technology (Poland)
Training and Research Center of the Federal Criminal Police Office (Germany)
Bonch-Bruevich Saint-Petersburg State University of Telecommunications (Russian Federation)
Kharkiv National University of Radioelectronics
Lviv Polytechnic National University
State University of Telecommunications
Borys Grinchenko Kyiv University



Experimental Research of the Program Implementation



1. Before implementation — the **Laplace distribution**.

2. After — the **χ^2-distribution** with 4 freedom degrees.

The average score increased by **4 points** (from 76.3 to 79.3).

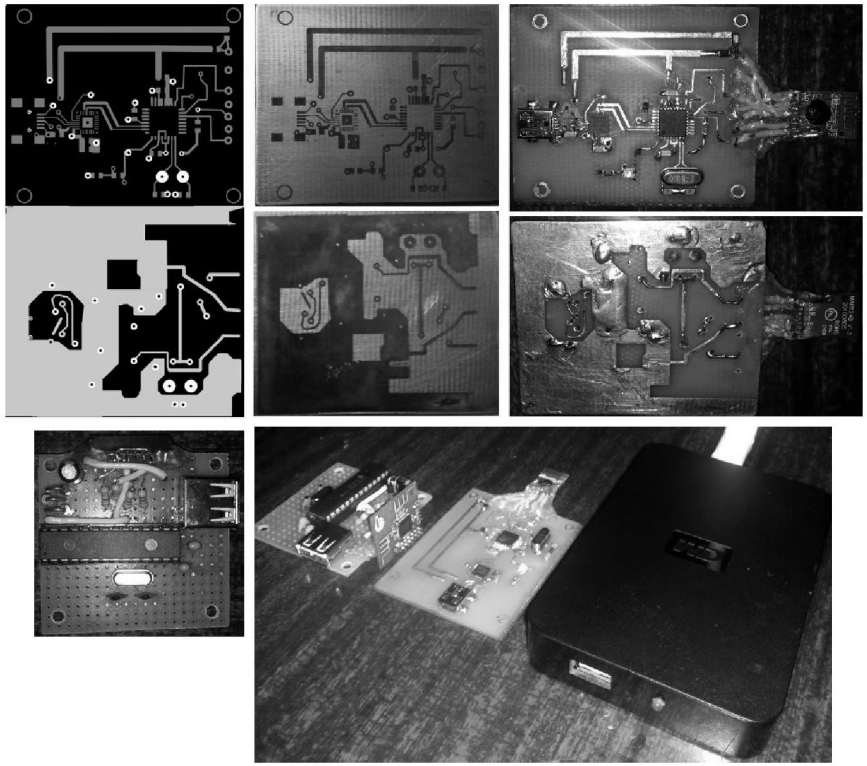
Examples of Master's Work

1. Hardware implementation
   - Analysis of integrity of data transmission in 2.4–2.5 GHz wireless communication channels using the hardware spectrum analyzer
   - Investigating wireless botnets and making recommendations on their use for implementing denial-of-service attacks
2. Software implementation
   - Software complex for comparative analysis of integrity of data transmission in 2.4-2.5 GHz wireless channels
   - Methodology of counteraction to social engineering at objects of information activity
3. Hardware and software implementation
   - Research on the security of low-power wireless technologies
   - Investigation of ways and recommendations on safety of monitoring systems of wireless ad hock networks in conditions of third-party influence

Analysis of Integrity of Data Transmission in 2.4–2.5 GHz Wireless Communication Channels using the Hardware Spectrum Analyzer

Student

Rossykhin Oleksandr Volodymyrovych



Results of Work:

- Detailed design process
- Production of printed circuit boards
- Collection of devices
- Testing and making improvements

Scientific Publication

Sokolov VY (2018) Comparison of possible approaches for the development of low-budget spectrum analyzers for sensory networks in the range of 2.4–2.5 GHz. Cybersecur: Educ, Sci, Technol 2 (in press) [publication in Ukrainian]

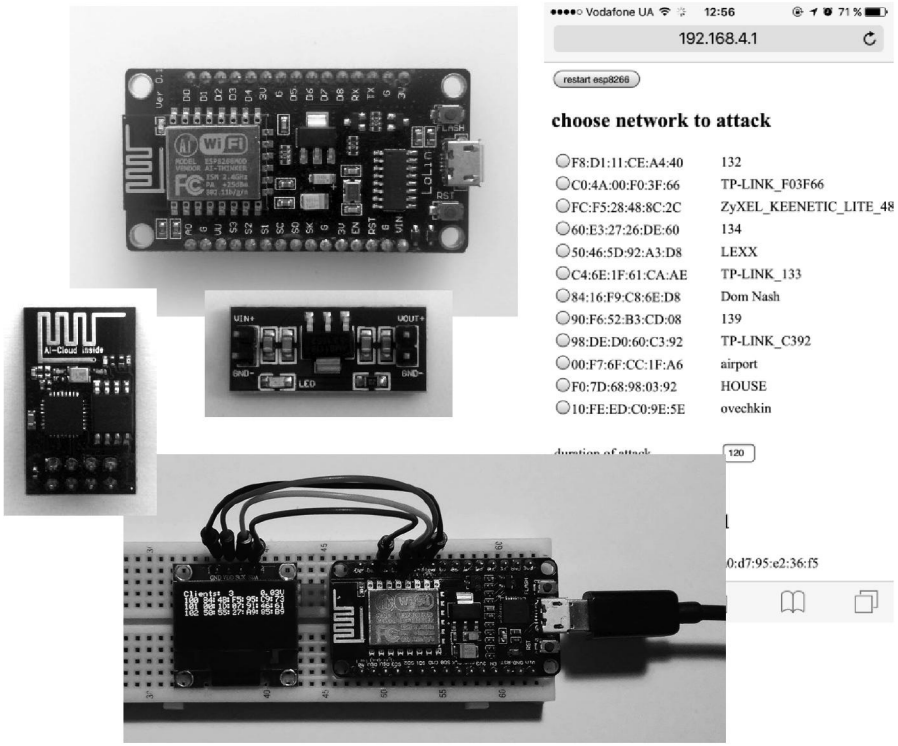
Investigating Wireless Botnets and Making Recommendations on Their Use for Implementing DoS Attacks

Student

Braslavskiy Mykyta Serhiyovych

Results of Work:

- Design process
- Manufacturing of wireless bots
- Conduct an experiment
- Testing and making improvements



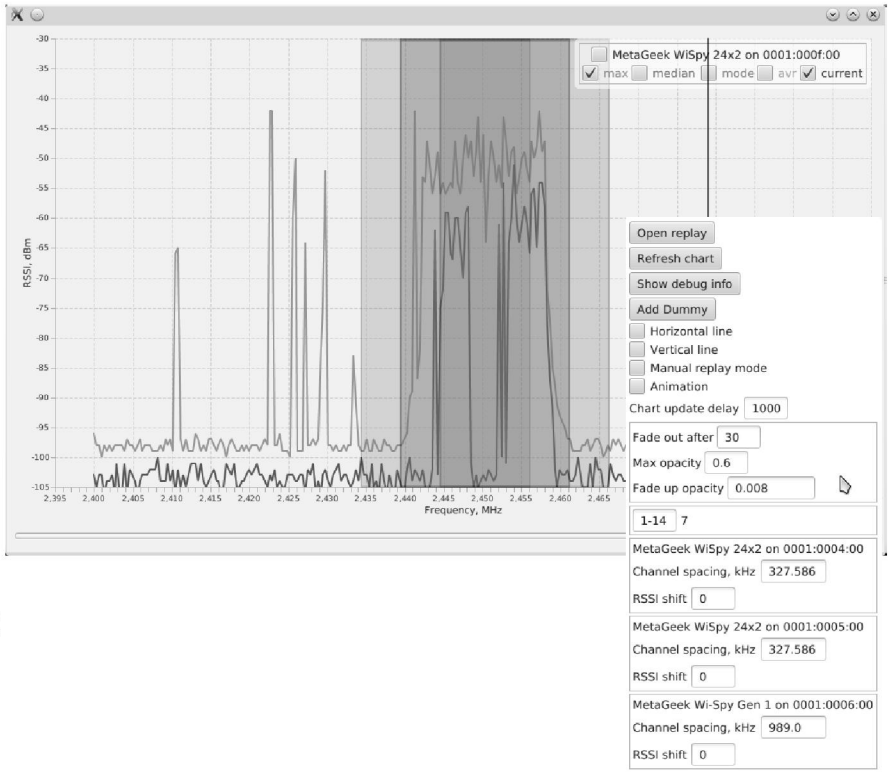
Scientific Publication

Buryachok VL, Sokolov VY (2018) Using 2.4 GHz wireless botnets to implement denial-of-service attacks. Web of Sch 24:14–21. DOI: 10.31435/rsglobal_wos/12062018/5734

Software Complex for Comparative Analysis of Integrity of Data Transmission in 2.4–2.5 GHz Wireless Channels

Student

Grebenyuk Oleksandr Volodymyrovych



Results of Work:

- Overview of technical characteristics
- Development of protocols
- Unification of work with modules
- Software implementation of interfaces

Scientific Publication

Buryachok V, Sokolov V (2015) Miniaturization of wireless monitoring systems 2.4–2.5 GHz band. In: 2nd International Scientific-Technical Conference on Actual Problems of Science and Technology (APST), SUT, Kyiv, pp 41–43

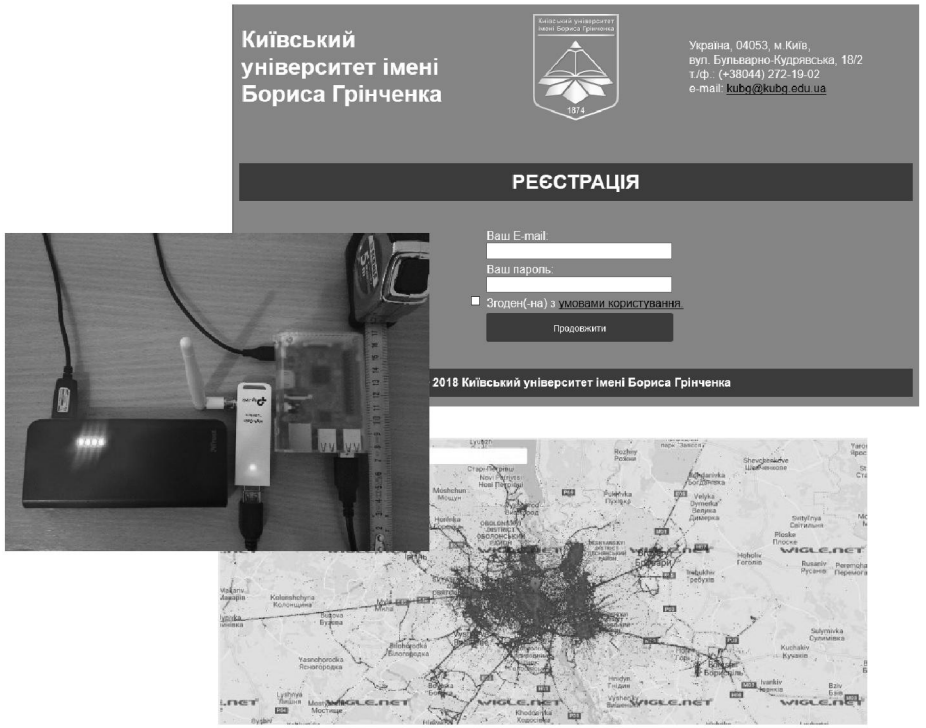
Methodology of Counteraction to Social Engineering at Objects of Information Activity

Student

Kurbanmuradov Davyd Mykolayovych

Results of Work:

- Development of a fake access point
- Fishing page design
- Collecting statistics
- Implementation of the stand



Scientific Publication

Kurbanmuradov DM, Sokolov VY (2018) Methodology of counteraction to social engineering at objects of information activity. Cybersecur: Educ, Sci, Technol 1:6–25 [publication in Ukrainian]

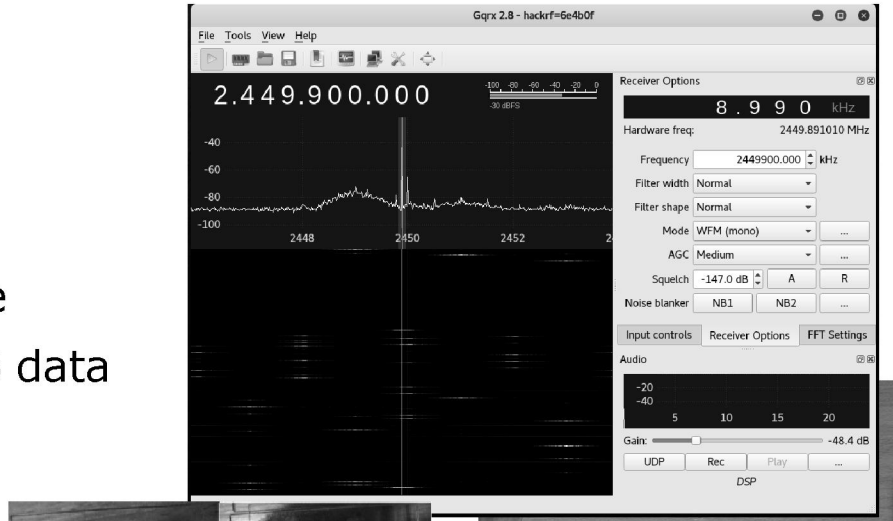
Research on the Security of Low-Power Wireless Technologies

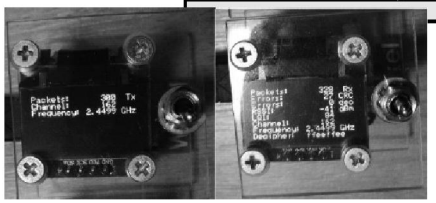
Student

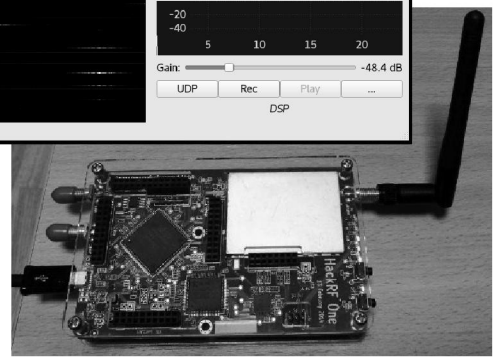
Taj Dini Makhiar Madzhyd

Results of Work:

- Type of human attack in the middle
- Collection of IEEE 802.15.4/802.16 data
- Analysis of received packages
- Implementation of the stand





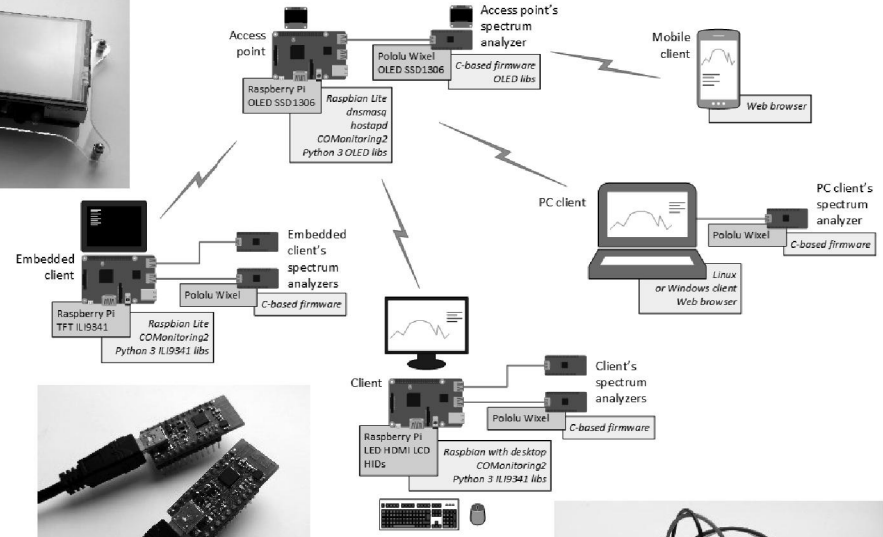


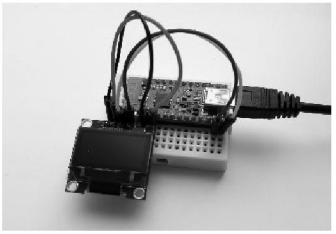
Scientific Publication

TajDini M, Sokolov VY (2017)
Internet of things security problems.
Mod Inf Prot 1:120–127. DOI: 10.5281/zenodo.2528814

TajDini M, Sokolov VY (2018) Penetration tests for Bluetooth low energy and Zigbee using the software-defined radio. Mod Inf Prot 1:82–89. DOI: 10.5281/zenodo.2528810

Investigation of Ways and Recommendations on Safety of Monitoring Systems of Wireless Ad Hock Networks in Conditions of Third-Party Influence





Student

Bogachuk Ivan Artemovych

Results of Work:

- Review of technical characteristics
- Spectrum research
- Programming services
- Implementation of the interface

Scientific Publication

Bogachuk I, Sokolov V, Buriachok V (2018) Monitoring subsystem for wireless systems based on miniature spectrum analyzers. In: 5th International Scientific and Practical Conference Problems of Infocommunications. Science and Technology (PICST), IEEE, Kharkiv, pp 581–585

Evaluation at 2018

November 15

Sokolov VY, Implementation of the world-wide methods of active training in the Master's program in specialty 125 "Cybersecurity"
Round Table "Cybersecurity: Educational Aspect"
Kiev Boris Grinchenko University, Kyiv

November 29

Buryachok VL, Introduction of Active Learning Technologies into the Educational Process in Borys Grinchenko Kyiv University
Cybersecurity & Intelligent Manufacturing Conference — 2018
Changsha, China

December 1

Babich AN, Active learning: implementation and popularization
Competition for projects among Student Action participants: Leadership competency development program for students
The British Council, Ramada Encore Kiev

December 8

Buryachok VL, Introduction of technologies of practice-oriented training in specialty 125 "Cybersecurity"
V Annual International Forum of Information Security Experts "Information Security: Trends - 2018"
Kiev Boris Grinchenko University, Kyiv

Future Work

According to the results of this international project and educational programs, it is planned to create a project of the **national master's standard** for the training of specialists in the field of cybersecurity.

Conclusions

The usage of active learning will allow:

- To harmonize international standards of the cybersecurity educational programs
- To prepare the translation of the current version of the CDIO standard (2.1)
- To improve the student's level in cybersecurity
- To increase the competence of specialists in cybersecurity and information security

Implementation of Active Learning in the Master's Program on Cybersecurity