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MODERN PROBLEMS OF RADIO ENGINEERING, TELECOMMUNICATIONS AND COMPUTER SCIENCE

Proceedings of the XIIth International Conference TCSET'2014

**Dedicated to the 170th anniversary
of Lviv Polytechnic National University**



**February 25 – March 1, 2014
Lviv – Slavske, Ukraine**

Ministry of Education and Science of Ukraine
Lviv Polytechnic National University



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Lviv
Publishing House of Lviv Polytechnic
2014

Міністерство освіти і науки України
Національний університет "Львівська політехніка"

**СУЧАСНІ ПРОБЛЕМИ
РАДІОЕЛЕКТРОНІКИ,
ТЕЛЕКОМУНІКАЦІЙ,
КОМП'ЮТЕРНОЇ ІНЖЕНЕРІЇ**

**Матеріали
XII Міжнародної конференції
TCSET'2014
присвяченої 170-річчю заснування
Національного університету "Львівська політехніка"**

**25 лютого – 1 березня 2014
Львів–Славське, Україна**

**Львів
Видавництво Львівської політехніки
2014**

TCSET'2014, February 25 – March 1, 2014, Lviv-Slavske, Ukraine

УДК 338.24-658.014
С 57

У виданні зібрано матеріали конференції, присвяченої науково-технічним проблемам у галузі радіоелектроніки, телекомунікацій та комп'ютерної інженерії.
Видання призначене для науковців, інженерів та аспірантів.

TCSET'2014

XIIth International Conference
"Modern Problems of Radio Engineering, Telecommunications, and Computer Science"

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IEEE Catalog Number:
ISBN 978-617-607-556-1

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ISBN 978-1-57-607-556-1

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Development of a New Information Technology for Efficient Application of Bulk and Nanostructured Crystalline Materials in Electro-Optical and Nonlinear Optical Devices <i>Anatoliy Andrushchak, Oleg Kushnir, Oleg Yurkevych and Andrzej Rusek</i>	347
Surface Hydrogenation of the Silicon Multicrystalline Substrate for Solar Cells <i>Anatoliy Druzhinin, Valeriy Yerokhov, Nicolas Berchenko</i>	351

SECTION 5

THEORETICAL, SOFTWARE AND ALGORITHMIC ASPECTS OF INFORMATION SYSTEMS AND TECHNOLOGIES DESIGN

SOA as an Enabler of the Agile Customer-centric Virtual Enterprise <i>Iryna Ivanochko</i>	355
Determination of the Set of Virtual Communities Indicators for Higher Education Institutions (Hei) <i>Korzh Roman, Peleshchyshyn Andriy, Trach Olha</i>	357
Overview of the Methods for Selective Encryption of MPEG-video of International Conference <i>Dmitry Komolov, Alexandr Slobodyanyuk, Nikita Kutya</i>	361
The Improvement of Operating Efficiency for University Library Content by Knowledge Bases <i>Taras Styslo, Khrystyna Vintoniv</i>	362
Algorithms and Hardware Components of Processors for Data Encryption in Rademacher-Krestenson's Delimited Number System <i>Volodymyr Kimak, Boris Krulikovskyy, Orest Volynskyy</i>	364
The Passive Method Error Analysis for Time Standards Collation Using Geostationary Satellites <i>Ivan Antipov, Viacheslav Pryimak</i>	367
Effective Method of Modular Multiplication in the Theoretical and Numerical Basis of Rademacher-Krestenson's <i>Mykhailo Kasianchuk, Igor Yakymenko, Stepan Ivasev, Yaroslav Nykolajchuk</i>	369
Remote Data Collection and Processing Software for Educational and Scientific Laboratory Complex <i>Yuriy Yakimenko, Oleksandr Bogdan, Anatolii Orlov, Andrii Zazerin, Victor Spivak</i>	370
Pattern Method of Web Project Management Optimization <i>Kateryna Alekseyeva</i>	373
The Concept Model of the Subject of Law as an Information and Communication Component of IT and Cloud Technologies <i>Lyubov Nykolaychuk</i>	375
New Techniques and Measuring Equipment for Construction of Algorithmic Software and Information Systems <i>Ivan Trotsyshyn</i>	377
Development Of Methods And Tools For The Objective Control Of Cultural And Professional Student'S Skills To Meet The 3rd Federal State Educational Standard Requirements <i>Evgeny Aidarkin, Marina Pavlovskaya, Dmitry Sherbina, Artem Starostin</i>	380
Investigation of Peculiarities Software Development for Embedded Systems <i>Anzhelika Parkhomenko, Olga Gladkova</i>	382
Ontology for Billing System Description <i>Danylo Antsybor, Larysa Globa, Maksym Ternovoy</i>	384
Features of Construction DLP Systems to Protect Computer Networks from Internal Threats <i>Alexander Petrov, Sergey Velchenko</i>	385
Cloud Technologies in the Integrated System of Preparation and Development Staff Bank <i>Vyacheslav Chaplyha, Volodymyr Chaplyha</i>	388
The Mathematical Model for the State of the Telecommunication System in Terms of Random Effects <i>Vladimir Popovskij, Vladislav Skibin</i>	390
Algorithm Analysis of Control Object Transitional States Based on Cluster Models <i>Nadiia Shyrmovska</i>	392
Background Modeling the Processing of Electronic Applications in the University <i>Oleksandr Markovets</i>	393
Synthesis of Primitive Matrices Galois and Fibonacci <i>Anatoly Beletsky</i>	394
Key Distribution in a Single-Photon Quantum Cryptography <i>Elizaveta Bolonna, Petro Shpatar</i>	396

Inform
Grigoriy
Linguist
the We
Oksana
Synthe
Olexiy I
Use of
Kateryn
Contou
Diana Z
Neuro
Olexan
Intellig
Myrosl
Archite
Unauth
Svetlan
Analys
Elena H
Applica
Profes
Scienc
Galyna
Detecti
Borys E
Featur
Artifici
Natalia
Techno
Iryna K
Techni
Analyti
Irina At
Neural
Orest H
Evaluat
in Insti
Nadiya

	Information Encrypting Based on Chaotic Systems and XOR Operations	398
	<i>Grigoriy Kosovan, Petro Kroyalo, Mikola Kushnir, Margarita Rozhdestvenska</i>	
347	Linguistic Method of Identifying Participant's Information Intentions in Information Activity on the Web	399
	<i>Oksana Tymovchak-Maksymets, Andriy Peleshchysyn</i>	
351	Synthesizing of an Improved Method for Hiding Data in Digital Images	400
	<i>Olexiy Dorozhan, Olesya Vovk, Andriy Astrahantsev</i>	
	Use of Help Desk System in Library Work	402
	<i>Kateryna Bukatevych, Serhiy Palyukh, Dmytro Tarasov</i>	
	Contour Segmentation Method in Video Surveillance Systems	405
	<i>Diana Zahorodnia, Kostantin Kovalok, Anatoly Sachenko, Viktor Krylov, Sergiy Nychyporuk</i>	
355	Neuro Fuzzy Predicting Mathematic Model of Computer Network Load	406
	<i>Olexandr Tarasov, Kostiantyn Polshchikov, Nikita Yeryomin</i>	
	Intelligent System for Detection and Classification of Computer Attacks	409
357	<i>Myroslav Komar, Vladimir Golovko, Anatoly Sachenko, Sergei Bezobrazov</i>	
	Architectural Solutions Used in the Creation of Algorithms to Protect Information from Unauthorized Access	412
361	<i>Svetlana Sakharova, Britskiy Sergey</i>	
	Analysis of Statistical Data of Card Fraud	413
362	<i>Elena Nyemkova, Vyacheslav Chaplyga</i>	
	Application of Modern Information Technology in the Educational Process for the Purpose of Professional Training in the Field of Radio Engineering, Telecommunication and Computer Science	415
364	<i>Galyna Kopets, Andrew Dzyubina</i>	
	Detection of Very Long and Power Signal in Information Radio Systems	418
367	<i>Borys Bondarenko, Vitalij Datsyk, Volodymyr Tymchuk</i>	
	Features of Structure Identification of Models of Distributed Parameters Objects Based on the Artificial Bee Colony Algorithm	419
369	<i>Natalia Porplytsya, Mykola Dyvak, Irina Spivak, Taras Dyvak</i>	
	Technology of Tests Qualitative Analysis Producing	421
370	<i>Iryna Kutsevych</i>	
	Technical Decision Justification on the Stage of Design Specifications Development by Analytic Hierarchy Process	422
373	<i>Irina Atamanova, Larysa Hlinenko, Volodymyr Fast</i>	
	Neural Controller for Robot Arm	425
375	<i>Orest Ivakhiv, Markiyan Nakonechnyy, Taras Repetylo</i>	
	Evaluation of Results Information and Education Activities as Part of Management Accounting in Institutions of Higher Education	426
377	<i>Nadiya Khorunzhak, Yaroslav Nykolajchuk</i>	
	SECTION 6	
	TELECOMMUNICATION SYSTEMS AND NETWORKS	
380		
	Noise Immunity Assessment In Telecommunication Systems with Cascade Encoding Structures	431
382	<i>Juliy Boiko, Oleksander Eromenko</i>	
	Frame Synchronization Symbols for an OFDM System	434
384	<i>Ali Eyadeh</i>	
	Principles of Access Networks Design Considering the Changes in the Number of Users	437
385	<i>Galyna Gayvoronska, Svetlana Sakharova, Oleg Domaskin</i>	
	Energy Efficiency of the Networks	438
388	<i>Andriy Luntovskyy</i>	
	Application Features of the Modern Microwave Systems Usage in the Mobile Networks	441
390	<i>Andriy Shokotko</i>	
	Proposals for the Integration of Various Wireless Sensor Networks	444
392	<i>Shostko Igor, Sosedka Julia</i>	
	The Data Transfer Systems With Using of the Noncoherent Detection of the Chaotic Signals	446
393	<i>Ruslan Politanskiy, Mykhailo Klimash, Yuriy Bobalo</i>	
	The Cooperative Spectrum Sensing Performance Research in Cognitive Radio Networks	448
394	<i>Kyryk Maryan, Yanyshyn Volodymyr, Dmitry Kozhurov</i>	
	Features of Analysis of the Interdomain Routing in WAN-networks	451
396	<i>Sergey Vorontsov, Kirill Trapezon</i>	

560	Combinatorial Method of Constructing a Vector Layer Semantic Structures Images <i>Vladimir Barannik, Andrey Shiryayev</i>	619
	Quality Indicators for Steganographic Transformations of Images <i>Vladimir Barannik, Bekirov Ali, Konstantin Tryfonenko</i>	620
563	Analysis of Options for Increasing Secrecy of the Videosystem resource <i>Sergey Sidchenko, Vladimir Larin, Roman Tarnopolov</i>	621
565	The Calculable Complication Estimation of the Compression Method Realization and the Images Regeneration with the Use of Extended Recurrence Reverse Position Structural-Weight Coding <i>Vladimir Barannik, Andrii Krasnorutskij, Yuliia Boiko</i>	622
568	Methods of Constructing Dictionaries in Compression Algorithms LZ-family <i>Sergey Pugachev, V. Tretyak, Konstantin Yurchenko</i>	623
569	Video Information Safety Increase Method of Emergency Situations Aero Monitoring <i>Yudin O, Oleg Kulitsa, Shkolnyk A.</i>	624
571	Image Segmentation Based on Neural Network Technology <i>Dmytro Mitiev</i>	625
573	The Transform with Comb Distribution Wavelet Function for the Texture Segmentation of Images <i>Marina Polyakova, Alesya Ishchenko, Oleg Pavlov</i>	627
576	The Adaptive Synthesizers of the Models for the Numerical Characteristic of the Arrays of Primary Inventory <i>Olena Zadorozhnyia</i>	629
578	Reduction of Visual and Space Redundancy of TV Images <i>Victor Zagrebnyuk</i>	630
581	Verification of Socio-Demographic Characteristics of Virtual Community Members <i>Solomia Fedushko, Andriy Peleschyshyn, Roman Korzh, Yuriy Syerov</i>	631
585	Welding Defects Adaptive Segmentation on Radiographic Images <i>Iryna Ivashenko, Teodor Mandziy</i>	633
587	Color Concentration Features for Metal Physical Properties Analysis <i>Roman Melnyk, Illya Kozhukh</i>	635
590	Negotiation of a Priori Uncertainty of Image Fractal Properties by Histogram <i>Alexander Parshin</i>	637
593	Information Technology of Multilevel Transformation of Mammogram Analysis Results <i>Serhii Holub, Svitlana Palash</i>	639
595	The Method of Sub-pixel Accuracy for Coordinate Measuring Systems <i>Iosip Bilynsky, Irina Sukhotska</i>	640
597	Energetic Efficiency of Methods of Spectral Representation in Signal Detection Problems <i>Levchunets Denis, Babii Yuliia</i>	641
599	Allocation of Homogeneous Areas on Fracture Surface Images by Means of Point Process Features <i>Rostyslav Kosarevych, Bohdan Rusyn, Oleksandra Student, Oleg Kapshiy, Mykhaylo Kobasiar</i>	644
601	Application of Multi-Level Information Transformation into Socio-Hygienic Monitoring <i>Victoria Nemchenko</i>	647
603	Convert Forms of Information in the Management of Mobile Robot <i>Vadym Nemchenko</i>	648
605	Electromagnetic Type Ultrasonic Transducers Design Improvement <i>Yaropolk Prytulyak, Stephania Prytulyak</i>	649
607	Approaches to the Elimination of Visual Information Defects <i>Lyubov Pinchuk, Aleksandr Pryadko, Tamara Gumen, Kirill Trapezon</i>	652
610	The Comparison of Segmentation Methods of Metallographic Images <i>Kerod T.I., Rusyn B.P., Kosarevych R.Ya</i>	654
611	The Input Data Array (IDA) Format is Unified to Ensure the Consolidation of Heterogeneous Models, Synthesized by the Model Synthesis Algorithm <i>Maria Golub</i>	656
	Develop a Universal Technique of the Organization Control Parameters Multi-Structured Company <i>Ilya Skumatenko</i>	658
	Application External Optical Rotating Filters for the Formation of Three-dimensional Images <i>Mykhailo Chervoniuk, Viktor Spivak</i>	659
615	Transcoding of Video Files During the Non-Linear Editing <i>Bogdan Verzhbitskiy, Oleksii Liebidiev, Alexander Prjadko</i>	660
618		

Determination of the Set of Virtual Communities Indicators for Higher Education Institutions (HEI)

Korzh Roman, Peleshchyshyn Andriy, Trach Olha

Abstract - In this article, the social relevance indicators are defined according to a standard set of socio-demographic characteristics, communication and social indicator of virtual community and importance of group characteristics.

Keywords - Higher Education Institutions (HEIs), Virtual community, Social relevance, Communication value, Communication complexity, Thematic relevance.

I. INTRODUCTION

Virtual communities over the Internet are once of the most prospective information environments of the HEIs. However, a significant number of thematically relevant communities for the HEIs originate the problem of selecting the set of those that are much more relevant with provision for the other criteria. Further the concept of a set of virtual community indicator for the higher education institutions (HEIs), namely: the social relevance, the communication value, the communication complexity and the thematic relevance are proposed.

II. DETERMINATION OF THE SOCIAL RELEVANCE

Socio-demographic characteristics of virtual communities identify the nature of the audience, which forms the community and, consequently, the proximity of a community task facing higher educational institutions in a process of information activities.

Socio-demographic indicators of virtual communities (VD - groups) are:

- domain (VDRg);
- age (VDAge);
- education (VDSL);
- profession, occupation (VDWD).

The degree of specific community socio-demographic characteristics proximity to the auditorial HEIs for certain thematic group a set of values is an indicator of social relevance and stands for a crucial coefficient to an extent of the virtual communities and generators of information image importance.

Control values are formed by experts on a base of

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tasks of information activities within a certain community groups.

The list of community groups is formed for the reason of the main HEIs activities with the reference to information activity:

- educational communication;
- business (administrative) communication with students;
- work with matriculants and marketing of educational services;
- scientific communication and marketing of research results;
- administrative activities and staff monitoring;
- economic activity;
- social, cultural and sport activities. [1]

A standard set is formed for each of the specified areas that underlies determining of proximity degree of a particular virtual community to the required, which determines the relevance of the social community. We use this indicator to identify the Euclidean measure of proximity.

Supposing $\overline{VD}^{(P)}$ - standard set of socio-demographic characteristics for the direction of P-activity and $Imp(VD^{(P)})$ - importance of VD-group characteristics for P-destination, moreover

$$\sum_{IMP_x \in IMP(VD^{(P)})} IMP_x = 1 \quad \text{and} \quad 0 \leq IMP_x \leq 1$$

$$\forall IMP_x \in IMP(VD^{(P)}).$$

Then social community relevance in P-direction:

$$Soc\ Re I^{(P)}(VC_i) = 1 -$$

$$\sqrt{\sum_{VD_x \in VD^{(P)}} \frac{\rho^{(SR)}(VD_x(VC_i), \overline{VD_x})^2}{Diametr^{(SR)}(VD_x)^2} Imp(VD_x^{(P)})} \quad (1)$$

where: $Diametr(VD_x)$ - maximal flow rate difference in attribute values VD_x , $Imp(VD_x^{(P)})$ - scaling factor for the VD_x feature in P-direction, $\rho^{(SR)}(VD_x(VC_i), \overline{VD_x})$ - numerical measure of the difference between the basis for the community and control the distance between them.

The function $\rho^{(SR)}(VD_x(VC_i), \overline{VD_x})$ is computed according to the formal features of criteria, not directly as an arithmetic difference. Let us consider this question in details.

Each of the criteria are not scalar, but are rather complex objects, which can be described at least as the probability distribution for a given set of values.

Moreover, for VDRg indication description can bear multi-layered nature.

In this case, "value difference" is thought to be a certain dimension, which reflects the proximity of two objects of the same structure – the standard and the real one. Such value is calculated according to the rules of a particular domain (for example, the calculation of proximity by region must include the geographic coordinates and administrative division). The definition of proximity measures is scientific and applied problem for social and marketing researches and goes beyond the scope of this work. [2]

In case it is mutually and is considered as a platform for information activities for several areas, the largest set of indicators for directions is taken as an indicator of social relevance:

$$\text{SocRel}(VC_i) = \max_{\{P_i\}} (\text{SocRel}^{(P_i)}(VC_i)) \quad (2)$$

where $\{P_i\}$ - a quantity system of all direction activities.

Importantly, the change of enumeration of Higher Education Institutions (HEIs) direction activities and socio-demographic characteristics does not lead to the change in the method of calculating the social virtual community relevance.

III. DETERMINATION OF THE COMMUNICATION VALUE AND COMMUNICATION COMPLEXITY

Communication specifications describe rules and style of communication in virtual communities and, therefore, serve as the basis of the applied techniques of effective communication in communities of various kinds. These characteristics are divided into the following groups:

- terms of Registration and Identification (a need to provide personal information (VGPD), possibility of presenting professional data (VGWD), usage of single social networking profile (VGSN));
- advertising and marketing information (allowed advertising (VGAd), allowed information about the organization and announcements (VGN), allowed a link to their own information resources (VGSR));
- language characteristics and the nature of rhetoric (procedural language community (VGHL), the general level of aggressiveness (VGAG), the presence of deliberate trolling (VGTR), moderation stiffness (VGMR), usage of profanity (VGPC)).

In practice, the formalization of communication value is an important feature of intellectualization software and algorithmic means of information activities. This applies to:

- facilitation of registration of membership in the community;
- intellectual posts verification for compliance with the rules of the community;

- constructing algorithms for finding optimal performers for each community separately.

Some indicators (VCMR, VCPC etc.) should be used to formalize communication procedures in hostile environments (for instance, appealing community moderator in accordance with opponent's abuse). [3]

In addition, two synthetic indicators are based on the characteristics of this group: the value of communication and communicative difficulties, which should be used in determining the overall importance of community.

Indicator of communicative value states in which way the community rules are beneficial to the *Higher Education Institutes (HEI)* in terms of active informational activity, that is, as far as possible to benefit in terms of improving the information image of the HEI. For example, a community where posting links to their own resources is prohibited, are less valuable than similar communities, where it is allowed. Given a list of basic characteristics define this indicator as a following:

$$\begin{aligned} \text{ComUf}(VC_i) = & \text{SocRel}(VC_i) \cdot \text{VGPD}(VC_i) * \\ & * VCU^{(VGPD)} + \text{VGSN}(VC_i) \cdot VCU^{(VGSN)} + \\ & + \text{VGAd}(VC_i) \cdot VCU^{(VGAd)} + \text{VGN}(VC_i) * \\ & * VCU^{(VGN)} + \text{VGSR}(VC_i) \cdot VCU^{(VGSR)} \end{aligned} \quad (3)$$

where: $VCU^{(VGPD)}$, $VCU^{(VGSN)}$, $VCU^{(VGAd)}$, $VCU^{(VGN)}$, $VCU^{(VGSR)}$ - appropriate weighting coefficients for performance.

Indicators of social relevance factor $\text{SocRel}(VC_i)$ stands for the multiplier for weighted sum of features.

Communication complexity factor indicates how time consuming and difficult is the basic of communicative activities in the community (without substantive aspect), that is, how difficult is the communication on universal level. High level factor indicates a potential threat to the image of the device by the concept of evaluating by society a person whom he or she communicates with. As a result, participation of representatives of higher education institutions in such communities should be limited to circle of people who have special psychological and rhetorical training. Accounting such representatives is useful feature is the integrated computer and information management system.

Considering a given list of basic characteristics let us define the communication complexity indicator as a following:

$$\begin{aligned} \text{ComCost}(VC_i) = & \text{VGHL}(VC_i) \cdot VCU^{(VGHL)} + \\ & + \text{VGAG}(VC_i) \cdot VCU^{(VGAG)} + \text{VGTR}(VC_i) * \\ & * VCU^{(VGTR)} + \text{VGMR}(VC_i) \cdot VCU^{(VGMR)} \end{aligned} \quad (4)$$

where: $VCU^{(VGHL)}$, $VCU^{(VGAG)}$, $VCU^{(VGTR)}$, $VCU^{(VGMR)}$ - appropriate weighting coefficients for the

performance, $VGHL(VC_i)$ - numerical function that reflects the usage of one or another language. Inverse dependence of moderation is typical for the indicator $VGMR(VC_i)$. This is due to the fact that, contrary to common opinion, mostly strongly moderated communities are easier for communicative environment in terms of users with a high level of culture and education (to which respectively refer representatives of the university, academic staff and administration).

Communication complexity factor is one of the components of the overall indicators of using community. [4]

IV. DETERMINATION OF THE THEMATIC RELEVANCE

A set of indicators that further characterize virtual communities in comparison to traditional websites has been considered above. The formalization of these characteristics is the basis of a unified information and mathematical models of universal folder of web communities.

However, for some problematic areas more additional characteristics that reflect their specificity should be devoted to the web-community.

Recording and analysis of community educational profile is important for the university, regardless of whether the community is targeted to higher education. For certain tasks facing universities (such as career guidance) require information activities in these communities.

In this way, the basic characteristics of virtual community in educational field VC_i is described by a tuple:

$$VCS_Ch(VC_i) = (VT(VC_i), VA(VC_i), VI(VC_i), VD(VC_i), VC(VC_i), VS(VC_i)) \quad (5)$$

where: $VS(VC_i)$ - group of special characteristics for community in educational field.

Taking as a subject problematic area in education field we distinguish the following additional characteristics for subgroups communities:

- educational profile;
- community issues;
- tone of the community;
- association with the institution.

Special performance of virtual community in educational field (group VS) of listed above groups:

- Association with the institution (maintenance (VSTS), influence on policy moderation (VSMP), traffic exchange from the official site (VSTE), availability of information obligations regarding community support (VSIS), usage of a single account (VSCA)).
- The educational profile and community issues (educational level (VSSL), community subject (VSTh), the main problems, which are discussed

(VSP), the main task of participants (VSMA), the main motivation of the owners (VSMM)).

- The tone of the community (attitude to education in general (VSLR), attitudes towards educational institution (VSUR), the presence of negatively motivated participants (VSAM)).

The above characteristics bear socio-communicative, humanitarian nature, but their incorporation into formal models and architecture of information management activities system allow the university to expand the possibilities for optimizing staffing process and quality control assignments. Individual characteristics (use of profanity, tone) can be set according to applied linguistics analysis of texts, including algorithmic means of lexicographical and sentiment analysis.

Given values are used to modify the parameters of the communicative value (see (3), (4)) and communication complexity based on the features of virtual communities and the educational direction of their subjects and to determine the relevance of content meaningful community areas of the university. [5]

Supposing $\overline{VST}^{(T)}$ - standart set of characteristics and problems of the community profile for the direction of P and $Imp(VST^{(T)})$ - importance of the attributes of the VST group for thematic areas T , while

$$\sum_{IMPx \in IMP(VST^{(m)})} IMPx = 1 \quad \text{and} \quad 0 \leq IMPx \leq 1$$

$$\forall IMPx \in IMP(VST^{(Th)})$$

Then the community thematic relevance in the subject T :

$$ThRel^{(Th)}(VC_i) = VSA(VC_i) * (1 - \sqrt{\sum_{VDx \in VD^{(Th)}} \frac{\rho^{(TR)}(VSTx(VC_i), \overline{VSTx})^2}{Diameter^{(TR)}(VSTx)^2}} * \sqrt{ImP(VSTx^{(Th)})}) \quad (6)$$

where: $Diameter^{(TR)}(VSTx)$ - maximum flow rate difference in attribute values $\rho(VSTx(VC_i), \overline{VSTx})$ - numerical measure of the difference between the criterion for the community and control, the distance between them $VSTx$, $Imp(VSTx)$ - scale factor for the criteria $VSTx$ ((coefficient is not determined for each subject separately Th , considering the large number of possible subjects for the HEI)) $VSA(VC_i)$ - association coefficient of the university community.

$$VSA(VC_i) = VSMP(VC_i) \sqrt{VSTE(VC_i)} \sqrt{VSIS(VC_i)} \sqrt{VSCA(VC_i)} \quad (7)$$

The function $\rho^{(TR)}(VSTx(VC_i), \overline{VSTx})$ is defined as the formal distance between the semantic concepts or subjects. To determine this distance it is advisable to use the theory of graphs (route length between the nodes of

the semantic network), semantic analysis (proximity concepts) and fuzzy logic (linguistic variables).

Obviously, for the Higher Education Institutes (HEI) there are a number of thematic areas that form appropriate set $\{Th_i\}$, which describes the whole complex of subjects that are relevant information of the university activities. When the greatest of criteria by categories is taken as a content relevance indicator.

$$ThRel(VC_i) = \max_{\{Th_i\}} (ThRel^{(Th)}(VC_i)). \quad (8)$$

Subject relevance is specifying coefficient to determine communicative value. Thus, community communication value can be substantially reduced if contextual relevance is low. Thus the rate of communicative value of educational communities $ComUfE(VC_i)$ is obtained by incorporation of content relevancy community:

$$ComUfE(VC_i) = ComUf(VC_i)ThRel(VC_i). \quad (9)$$

Communicative complexity factor of the educational community is formed by correcting the total communication complexity factor (4) considering features of the educational community.

$$\begin{aligned} ComCost(VC_i) = & VSL(VC_i)VGHL(VC_i) * \\ & *VCU^{(VGHL)} + VGAG(VC_i)VCU^{(VGAG)} + \\ & + VGTR(VC_i)VCU^{(VGTR)} + VGMR(VC_i) * \\ & *VCU^{(VGMR)} \end{aligned} \quad (10)$$

where: $VSL(VC_i)$ - indicator of community loyalty:

$$VSL(VC_i) = VSLR(VC_i)VSUR(VC_i)VSAM(VC_i) \quad (11)$$

Communicative complexity factor of the educational community is one of the components of the overall criterion for using community to carry out information activities in the Higher Education Institutes (HEI) [6].

V. CONCLUSION

Mentioned above set of indicators is oriented on communication tasks, though their incorporation into formal models and the ATM Architecture & Information Management activities allow the HEIs to expand the possibilities for optimizing staffing process and quality control assignments. Some criteria can be identified by using computer-linguistic analysis of texts, in particular algorithm means of lexicographical analysis.

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