

Stigmergy processes in the function of Web information system management and their importance in the development of small and medium-sized enterprises

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Abstract: Stigmergy processes are a key factor in the development of information systems for small and medium size enterprises, they represent an efficient, applicable, cost-effective and reliable solution, their future implementation will be crucial in the progress and survival of the Web based enterprises. Development of the company which offers software supports to their clients, use this type of software for autonomous development, systems based community support, grouping and dedicated to the development of such type of products, plays a crucial part in products development. Enthusiasm of the community oriented members has a crucial part in the open source software processes, where members take active take part in the development, improvement of functionality, mechanisms of coordination, stability, efficiency, and the software security. Stigmergy is a term taken from biology, presents a mechanism for controlling and coordinating the work of individual and the environment, members and the environment as an enclosed system, for the benefit of community and all their individuals. Many processes on the Internet are stigmergy oriented and based, and its understanding is crucial for the future processes of Internet development.

1. INTRODUCTION

Stigmergy processes are a key factor in the development of information systems for small and medium size enterprises, they represent an efficient, applicable, cost-effective and reliable solution, their future implementation will be crucial in the progress and survival of the Web based enterprises. Development of the company which offers software supports to their clients, use this type of software for autonomous development, systems based community support, grouping and dedicated to the development of such type of products, plays a crucial part in products development. Enthusiasm of the community oriented members has a crucial part in the open source software processes, where members take active take part in the development, improvement of functionality, mechanisms of coordination, stability, efficiency, and the software security. Stigmergy is a term taken from biology, presents a mechanism for controlling and coordinating

the work of individual and the environment, cooperation of members and the environment as an enclosed system, for the benefit of community and all their individuals. Many processes on the Internet are stigmergy oriented and based, and its understanding is crucial for the future processes of Internet development.

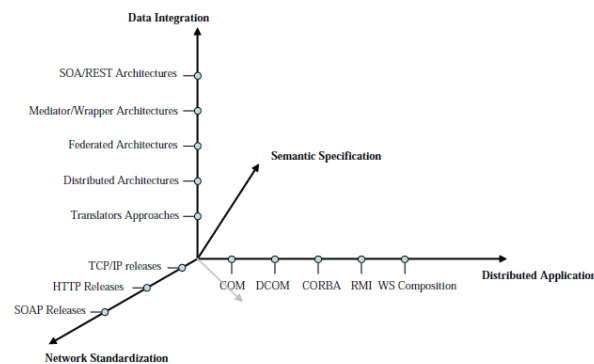
Complex software applications, web sites, magazines, encyclopedias, social sites are result of stigmergy processes, where members without fees of restrictions, use complete software code or part of it, modify it, commercial monopoly is excluded and is not constrain factor in continuous software developing. Stigmergy process paradigm, with "work in progress" as the slogan, represents an essential factor, where the modification of the environment serves as external systems memory, encompasses work groups or individuals into a continuous chain of upgrades and improvements.

In this study of stigmergy processes, special attention will be focused to the Drupal development, the CMS open source software, as a practical application realized on than one million Web sites and applications, its development is supported by hundreds thousands of active users, who in their own and benefit and goodness of community, working in active modules development, the software implementation which its strength exceeds all community together, and whose adaptability and creativity, system resources, wide theoretic and practice area, economic feasibility, presents a challenge for all competing products. Applicability of the Drupal CMS system in the following areas: electronic commerce, web information systems of small and medium enterprises, on-line magazines, travel agencies, media web sites, systems of education, scientific research projects, etc. In the practical part of the paper we show Drupal system and its implementation in the distance learning system, as a real-time effective solution for on-line education system.

2. SYSTEM, INFORMATION SYSTEM, WEB INFORMATION SYSTEM

In the analysis of information systems in modern interpretation has far greater significance, we start from the system that is commonly defined as a set of entities, at least two, organized to perform a particular function, while interaction of parts creates a whole. That is a set of interrelated dependent parts which together form a whole so that this set has a specific purpose, goal and changes in any part leads to changes in another part to. [1]

Information system is an integrated system of human activities and technologies that support the operations, management and decision making. Today's information system show is multidimensional, presented three axes with its elements in the way of data integration, of network standardization and distributed applications.



[2]

3. OPEN SOURCE SOFTWARE AND STIGMERGIC PROCESSES IMPORTANCE

The open source processes are almost identical to the termites colony building, process known as stigmergy. There is no centralized leader, no hierarchical project layout designs termite colonies. Stigmergy is simultaneous process between the communes-associations and its members, the work coordinating process for the systems improvements, in the benefit of the individuals and community development.

Basic stigmergic processes features are :

- individuals do not respond to centralized instructions
- each individual does in his own way
- mode of communication is via the environment (site, forum, blog, commercial support)
- system feedback, benefit of an individual from the community and the community of individual
- errors are discovered by accident but they prevail abundance of the commune and its willingness to help
- stability and persistence of components depends on the environment and each individual

- all structures lead to the improvement, simplification, the applicability of the product around which the community operates and works
- stable states of the system are multiple.

Stigmergy processes are based on the belief that hierarchy is extremely inefficient, where all personal is rely on the head person who manages all aspects of the activity, creativity and intuitiveness, inventiveness are completely ignore.

Open source software is those whose source code is publicly and available for elementary rules of usage, the code can be changed, adapted and improve. Such products are: Firefox, Joomla, Drupal, LINUX, MediaWiki, Wikipedia etc.

The GNU General Public License (GNU GPL or simply GPL) is the most widely used free software license, originally written by Richard Stallman for the GNU project. The GPL is the first copyleft license for general use, which means that derived works can only be distributed under the same license terms. Under this philosophy, the GPL grants the recipients of a computer program the rights of the free software definition and uses copyleft to ensure the freedoms are preserved, even when the work is changed or added to. This is in distinction to permissive free software licenses, of which the BSD licenses are the standard examples. [3]

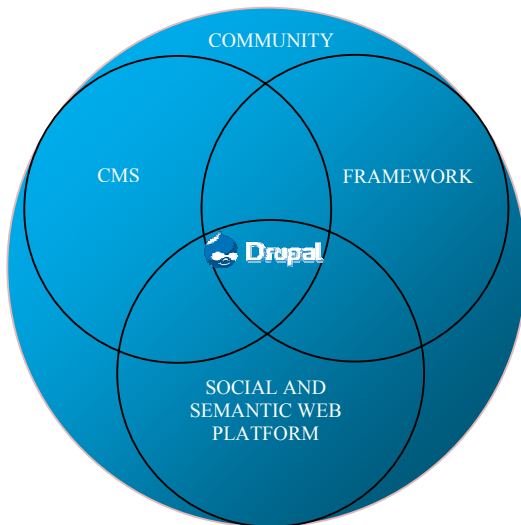
The classical economics model holds that people are intrinsically selfish, and will not do anything to help others—such as providing information products—without remuneration. Traditional economics is based on the assumption that private property rights are needed as an incentive for production. Only when you have full control over your production can you ask remuneration for it to the people who would like to use it. Moreover, the free market model assumes that competition is needed to optimize production: if people do not buy your products because they prefer the one of your competitors, you will be forced to improve your products or lower their price. When the major producers all cooperate, as in a cartel, competition is eroded and prices can increase freely without corresponding increase in quality. [4]

If small and medium enterprises are often showed as organizations including the qualities of flexibility and resistance, the auto-organization seems, on the other hand, very rarely held in reticular organizations. It is here that swarm intelligence, which include the phenomena of auto-organization of social insects, brings us elements of reflection in the light of the four main mechanisms that constitute the auto-organization phenomena :

- The existence of multiple interactions,
- Development by the positive feedback,
- End by Negative feedback,
- The amplification of fluctuations. [5]

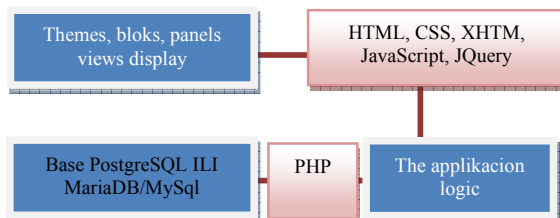
Using models of social insects allowed us, at first, to consider otherwise the mechanisms of coordination and control in a peculiar reticular organization, a grouping of small and medium-sized firms working on shared projects. [6]

4. DRUPAL APPLICATIONS LAYERS



[7]

Drupal is written in the PHP programming language, Java Script and Query libraries represent the standard programming tools, while the database is based on PostgreSQL or MariaDB/MySQL. Application layers of which was built Drupal application are:



With the slogan Come for the software, stay for the community, 656,444 people in 228 countries speaking 181 languages power Drupal. Drupal is an inevitable force of progress and continuous improvement. At the main Drupal Web sites: <http://drupal.org/> you can find information for the beginners and advanced user, conference theatres information, security patches, information about new modules and themes details installation instructions, diverse community, software and hardware system requirements. The Drupal is supported by community oriented individuals, diverse groups which are paid for the modules and specific code developments. On the various Web sites you can find books and video instructions, tutorials for the specific system functions. [8]



Drupal is highly modular, open source, Web CMS (Content Management System), its strength is based on great support and cooperation hundreds of thousands of passionate people and teams, working on powering improvement and upgrade of the system. As expandable, encompassed with advanced administrative interface, supported by teams of highly qualified programmers, the code are continually updated and improved, the security system is based on multiple Drupal layers.

The possibility of separation and the system maintenance organization is integrated into the very essence of the system architecture, hereby the presentation part is fully separated from the system code and maintenance parts, and is enforced by the system authorization and modularization. Drupal is constantly being improved by drupal.org associations through the permanent forums, blogs and conferences. "73 Sessions and 87 BoFs later it's all over and we can emerge from the DrupalCon bubble. DrupalCon London has been an amazing success with a final attendance of 1751. We're delighted to announce that as well as being the biggest European DrupalCon in terms of attendees, DrupalCon London was also a profitable event - investing over £38,000 back into the Drupal Community."



[9]

Many profitable organizations, small and medium size enterprises, contracts Drupal teams in the code improving and the module developments for the business requirements specifications. Drupal is used as a web portal, on-line journals, electronic commerce systems, photo galleries and systems of distance learning. Drupal is fully modular, new designee styles added via modules

and themes, that are integrated in the Drupal core or added as contributed themes or modules.

5. PRACTICAL DRUPAL SYSTEM IMPLEMENTATION

Drupal is practical web application used for everything from personal blogs to enterprise applications. Used for the different web sites, blogs, academic journals and conferences, electronic commerce systems, tourism organizations advertisements, the system of the distance learning, Drupal is used for the biggest Web sites.

A. Scientific conferences

Web site EDASOL scientific conference. Basic site information: Drupal versions 6.22, defined content types with CCK , View models used to present the various content types, theme Orange, administration theme Garland, languages: bilingual (serbina and english), 65 built in modules, search engine optimization is done with Drupal SEO modules. [10]



Web site scientific conference ICASUS.

Basic site information: Drupal versions 6.22, defined content types with CCK , View models used to present various content types, theme BlueMaster, administration theme Garland, site is bilingual (serbina and english), 75 built in modules, search engine optimization is done with Drupal SEO modules, Gmap optimization.[11]



B. Scientific journals

Basic site Emc-review and Gfnp scientific journals.

Sites information: Drupal versions 7.7, defined content types with CCK , View models used to present various content types, theme Ellington7 and Desk02, administration theme Garland, 40 built in modules, search engine optimization is done with Drupal SEO modules.



[12]



[13]

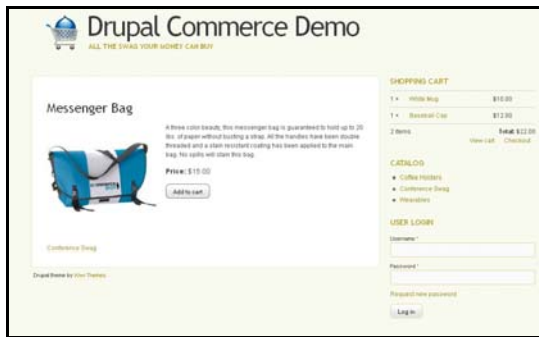
C. Tourism advertising sites



Basic site information: Drupal versions 7.7, defined content types with CCK , View models used to present various content types, theme Marinelli, 65 built in modules, languages (English, Croatia, Italian), built in content management system, search engine optimization is done with Drupal SEO modules. [14]

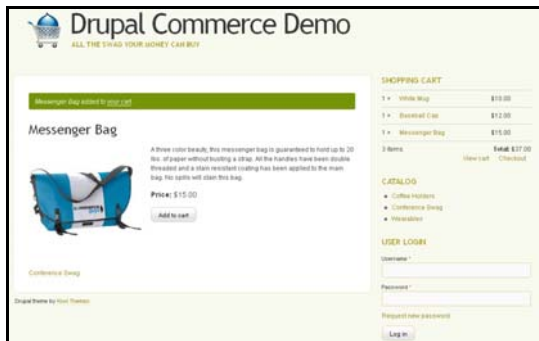
D. Electronic commerce

Demo Drupal pages with sa E-commerce solutions and merchandise details.



[15]

„Messenger bag“ is added and shopping chart as it is followed. Site is built with E-commerce Drupal moules.



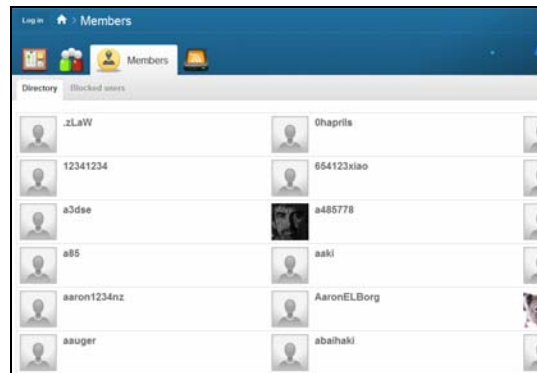
[16]

E. Social networks



[17]

Organic group: enables users to operate and maintain specific social groups. Every group is organized with its own members and social groups. Each group can have subscribers, and maintains a group home page where subscribers communicate amongst themselves. Groups may be selective or not. Selective groups require approval in order to become a member, or even invitation-only groups. There are lots of preferences to configure groups as you need. [18]

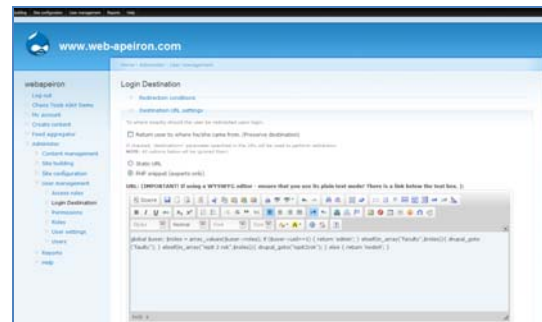


6. THE DISTANCE LEARNING SYSTEM *DRUPAL CMS*

A. Logging destination [19]

Login sessions implemented through PHP code:

```
global $user;
$roles = array_values($user->roles);
if ($user->uid==1) { return 'admin'; }
elseif(in_array("faculty",$roles)){ drupal_goto("faulty");
elseif(in_array("ispit 2 rok",$roles)){
drupal_goto("ispit2rok");
else { return 'node9'; }
```



Sessions redirect users to the specific site pages according to the previously defined roles of the system administrator conceptual design. It is possible to specify certain conditions like referring pages or user roles and make the destination depend upon them.

B. List of users, rights and filtering users by groups

Access rights are enabled through the checkmark of the individual fields and users groups of within the system permissions. The users are divided into precisely defined groups according to incoming subject or the exams period. Upon completion of the pre-preparation obligations users are moved to the examination group, finishing the testing duties most of the rights are blocked, except checking the result of the examination, polls overviews. Users are required to fulfill different polls "POLL" and leaves comments on the blog so that the whole process is improved or modified.

C. CCK – content konstrukcion kit [20]

CCK and View modules are the crucial part of Drupal system, due to its powers and extended functionality, special attention is focused on their practical value. CCK modules allows user to define content in accordance their own needs, content can be grouped to fulfilled conceptual and technical Web system designee. The key factor is to create the middle level of presentations as connection between raw database contents and node implementations. Hundreds of add-on are available for download for this modules to extends to create the most complex content system

Defined content types for the content Bijeljina students as basic category information about student are: name, surname, telephone number, E-mail, etc.



Bijeljina student content system organizations: The basic information are grouped into category as followed: student's information, preparation's materials, exercises, exams, while adapting modular system implementation is powered by Drupal API system.

Individual content presentation is student content type that has exactly the fields I need in accordance with the system requirements and presentation practical goals.

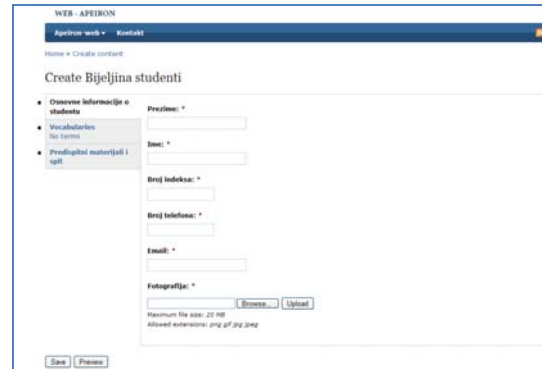
Photos preparing for the presenting format:

Defining "Preset - pre-defined elements" using the "Image cache" module to adapt the photo in a format requested, rendered through the Image cache actions. We previously defined the pictures formats (.jpg, .png, .gif) precisely defined size (100 x 100 px) and frame of 2px, frame color, using the "Define the canvas" presets. The implementation is shown in the CCK, photograph is presented on the rendered Web page.

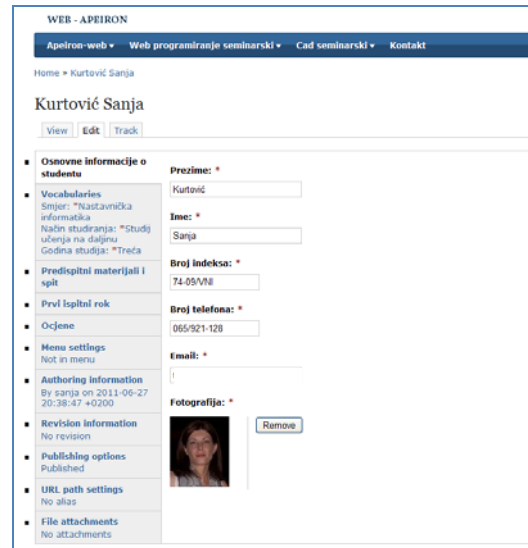
D. CCK menu implementation



Student creates content in order to log onto the system, collect pre-exam materials and gain information which for exams preparations. Student uploads pre-exam solved homework and questionnaires. Information are available for students to edit or delete.



Information available for administrator or professor for defined subjects:

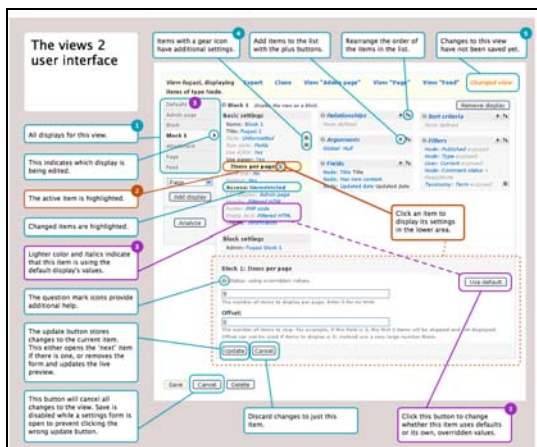


Field editing methods in construction phase:

Label	Name	Type
Title	node.module form	
Osnovne informacije o studentu	group_osnovne_bjelejni	Standard group
Ime	field_ime_bjelejni	Text
Prezime	field_prezime_bjelejni	Text
Broj indeksa	field_broj_indeksa_bjelejni	Text
Broj telefona	field_broj_telefona_bjelejni	Text
Email	field_email_bjelejni	Text
Fotografija	field_fotografija_bjelejni	File
Taxonomy	Taxonomy module form	
Predmeti materijali i opisi	group_predmeti_bjelejni	Standard group
Vredba I	field_vredba_jedan_bjelejni	File
Vredba II	field_vredba_dva_bjelejni	File
Vredba III	field_vredba_tri_bjelejni	File
Vredba IV	field_vredba_četiri_bjelejni	File
Vredba V	field_vredba_pet_bjelejni	File
Sumarnica	field_sumarnica_bjelejni	File
Prvi ispitni rok	group_prvi_ispitni	Standard group
Ispitni zadaci	field_ispitni_zadaci_bjelejni	File
Kvalitativni ispitni zadaci	field_ispitni_zadaci_bjelejni	File
Ocjene	group_ocjene_bjelejni	Standard group
Prva ocjena	field_ocjena_prva_bjelejni	Integer
Druge ocjene	field_ocjena_druge_bjelejni	Integer
Traka ocjena	field_ocjena_traka_bjelejni	Integer
Četvrta ocjena	field_ocjena_cetvrti_bjelejni	Integer
Peta ocjena	field_ocjena_peta_bjelejni	Integer
Sumarni broj bodova	field_sumarni_bodovi_bjelejni	Integer
Ispravak bodova	field_ispravak_bodovi_bjelejni	Integer

E. Content presentation using view module

Drupal is a stable platform based on relational databases (MySQL usually also have other types supported) while View modules is used to filter information out of the box and preset them on site pages. Drupal Help advance modules is integrated into View modules, shows how administrator can configures and present the above information in accordance with parsing and the system modularity.



Views interface interpretation (basic concepts):

- All displays in view: Every view has a number of displays which represent where output will be placed (Number 1)
- The active items is highlighted: When you click on the link for an item, a form will open up (Number 2)
- Lighter color and italic indicate that this item is using the default display's values. (Number 3)

- Items with a gear icon have additional settings - Some items, particularly styles, have additional settings. (Number 4)
- Changes to this view have not been saved yet - You can safely leave a view page to go and do other things. If you come back, the view will still be there, stored in a cache. (Number 5)

Views interface basic displays

- Fields are the individual pieces of data being displayed.
- Relationships allow you to expand the query to include objects other than the base query. This is actually made more difficult to understand by the fact that Views actually includes a few relationships by default, and doesn't tell you they're there.
- Arguments are input. While they often come from the URL, they don't always so please don't be shocked when they don't
- Filters are used to reduce the data set that Views provides. That is to say, without any filters applied, Views will return all of your content. You don't want that, so at least some filters must be used.
- Displays tell Views where the output should go. By adding a display to a View, you can have your view appear as a page, or as a block, or even as an attachment to a different display on the view.
- Sort criteria determine what order the records are retrieved from the database and displayed in.

During Drupal View installations process, other models are required to be installed to enable View integral tool modules fully functions. It is mandatory to install CTool as additional module to implement .inc files, AJAX responder, object caching, models dialogs.

F. Views in www.web-aperion.com system [21]

Web programming exams results are filtered from raw database, defined by CCK with special design of every data as construction field, View modules with database query represents results, and API does page finally rendering.

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Studenti za koje nije definisana konačna ocjena su obavezni doći na konsultacije ili izdati na sljedeći ispitni rok.

Pretraga:

Fotografija	Prezime	Ime	Broje indeksa	Seminarski br. bodova	Ispit web (kolokvij 1 i II)	Konačna ocjena
	Zmč	Dejan	60-06/VIT	30	35	7
	Zvanović	Aleksandar	137-06/VIT	30	50	8
	Vuković	Stefan	24-06/RET	30	35	9
	Vukob	Danko	149-06/VIT	25	30	8

Search result of Dragan as a name, results are presented in the in the below specified web pages. Photograph selections enables student to edit profile details, and leave comments inside specific Drupal nodes.

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Pretraga:

Fotografija	Prezime	Ime	Broje indeksa	Seminarski br. bodova	Ispit web (kolokvij 1 i II)	Konačna ocjena
	Tupic	Dragan	49-06/VIT	30	35	9
	Samčević	Dragan	26-06/VIT	30	25	6
	Kremenović	Dragan	44-06/RET	25	35	6

Exam results CAD-CAM-CIM presented in tabular View:

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Pretraga:

Prezime	Ime	Čad prisustvo	Čad vještbe	Čad seminarski rad	Čad ispit	Ukupna bodova	Čad konačna ocjena
Andrić	Mirjana	5	10	15	35	65	7
Anić	Jovan	10	10	20	25	65	7
Andrić	Vedran	10	10	20	30	70	7
Babić	Sasa	10	10	20	25	65	7
Babić	Predrag	10	10	30	25	75	8
Blazević	Stijana	10	10	30	45	95	10
Bogović	Nikola	10	10	25	35	80	8
Bogović	Vladimir	5	10	10	30	55	6
Bogović	Monika	10	10	20	40	80	8
Bosic	Marko	10	10	20	45	85	9
Bosic	Sljodan	10	10	20	35	75	8
Bubić	Nenad	10	10	25	45	90	9
Čak	Snježana	10	10	25	25	70	7
Čović	Stefan	10	10	20	35	75	8
Čović	Milan	10	10	20	30	70	7
Čović	Natalia	10	10	20	25	65	7
Čović	Nenad	10	10	20	40	80	8
Čović	Dragana	10	10	30	30	80	8
Davidović	Antonia	10	10	15	35	70	7
Davidović	Slavica	10	10	25	25	70	7

Sorting criteria is a final exams score:

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Pretraga:

Prezime	Ime	Čad prisustvo	Čad vještbe	Čad seminarski rad	Čad ispit	Ukupna bodova	Čad konačna ocjena
Tomč	Drago	5	10	30	50	95	10
Vasić	Aleksandar	10	10	30	45	95	10
Belanović	Predrag	10	10	25	50	95	10
Stojaković	Dusan	10	10	30	45	95	10
Pejić	Miro	10	10	30	50	100	10
Vuković	Dejan	10	10	30	45	95	10
Žigunović	Dragan	5	10	30	50	95	10
Blazević	Stijana	10	10	30	45	95	10
Jakić	Vedran	10	10	25	50	95	10
Kadić	Vladimir	10	10	30	45	95	10
Garić	Duško	10	10	25	50	95	10
Trifunović	Aleksandar	10	10	30	45	95	10
Hejrić	Aleksandar	10	10	30	45	95	10
Škarić	Nevenka	10	10	30	45	95	10
Spasić	Marko	10	10	25	40	85	9
Maleš	Robert	10	10	25	40	85	9
Čurčić	Vladimir	10	10	20	45	85	9
Bosic	Marko	10	10	20	45	85	9
Misc	Branimir	10	10	20	45	85	9
Čović	Vladimir	10	10	25	45	90	9

During the work process user permissions are control by system administrator, total time spent on systems, time spent exploring certain content and video presentation, different system's session, filling the questionnaires, are recorded accurately, illustrating the student's system or subject activity. Polls filled by students are the feedback system.

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Stojaković	Dusan	10	10	30	45	95	10
Pejić	Miro	10	10	30	50	100	10
Vuković	Dejan	10	10	30	45	95	10
Žigunović	Dragan	5	10	30	50	95	10
Blazević	Stijana	10	10	30	45	95	10
Jakić	Vedran	10	10	25	50	95	10
Kadić	Vladimir	10	10	30	45	95	10
Garić	Duško	10	10	25	50	95	10
Trifunović	Aleksandar	10	10	30	45	95	10
Hejrić	Aleksandar	10	10	30	45	95	10
Škarić	Nevenka	10	10	30	45	95	10
Spasić	Marko	10	10	25	40	85	9
Maleš	Robert	10	10	25	40	85	9
Čurčić	Vladimir	10	10	20	45	85	9
Bosic	Marko	10	10	20	45	85	9
Misc	Branimir	10	10	20	45	85	9
Čović	Vladimir	10	10	25	45	90	9

Session and login time are controlled for every system user:

Type	Date	Message	User
user	2011-08-16 20:45	Session opened for adrian.	adrian
user	2011-08-16 20:47	Session closed for adrian.	adrian
user	2011-08-04 20:05	Session closed for adrian.	adrian
user	2011-08-04 20:10	Session opened for adrian.	adrian
user	2011-08-04 20:11	Session closed for adrian.	adrian
user	2011-08-04 20:19	Session opened for adrian.	adrian
user	2011-08-04 20:22	Session closed for adrian.	adrian
user	2011-08-04 20:26	Session opened for adrian.	adrian

Test time trigger in a time interval X using Scheduler modules:

Menu settings
Not in menu

Scheduling options
Scheduled for publishing

Authoring information
By webapeiron

Revision information
No revision

Publishing options
Published

URL path settings
No alias

Save Preview

Publish on: 2011-09-02 17:00:00

September 2011

MO TU WE TH FR SA SU

1 2 3 4

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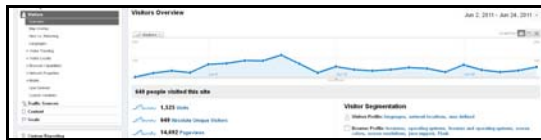
21:51:11

Closing the session in a given time interval Y:

Modules used for this session are “Data”, “Scheduler” and C-Tool modules. [22]

G. Google analytic

Google analytic module as final system feedback [23]



7. CONCLUSION

Open source web based system with community support, integration of members to build stronger associations, will be one of the key factor to enter into new stage, choosing highly modulated web solutions for small and medium sized enterprises. Adaptability, code adjustment, numerous modular solution will be competitive factor that will emphasize integrity and adaptability with huge knowledge bank and alternative module options (Drupal system has 8458 modular solutions, August 2011.). Commercial support, the ability of management to notice importance of stuff education, to create the software in the fast and efective way, cost effectiveness and implementation simplicity, IT teams preparation to applying those systems and adopt to our needs is continuous and endless competitive factor and it should be our long term strategy. Based on our innovation desire, response to the constantly changing environment, our flexibility, analitic system understanding in the space of continous upgrading and changes, stigmergic processes with open source software solutions in the incoming decades will be the key factor in the web information systems development.

8. REFERENCE

- [1] Radić Gordana, Upravljanje poslovnim informacionim sistemima, Panevropski univerzitet Apeiron, Banja Luka 2009
- [2] Encyclopedia of Information Sciences and Technologies, USA, Hershey PA 17033, 2009
- [3] http://hr.wikipedia.org/wiki/GNU_General_Public_License
- [4] Francis Heylighen, Stigmergic organization and the economics of information, ECCO Universiteit Brussel, <http://pcp.vub.ac.be/HEYL.html> , Open Source Jahrbuch 2007, Lehmanns Media, 2007
- [5] J.-P. Rennard, "Auto-organisation chez les insectes sociaux", in Ants Viewer, <http://www.rennard.org/alife>, 2003
- [6] Marie-Annick Montalan, Robert Descargues, Using Swarm Intelligence to improve the performances of a network of Small and Medium-Sized Companies working on shared projects, Laboratoire Gestion et Cognition, IUT Ponsan - Université Paul Sabatier
- [7] Benjamin Melancon, Lacine Luisi The Definite Guide to Drupal 7, Apress, 2011
- [8] <http://drupal.org/>
- [9] <http://london2011.drupal.org/>
- [10] <http://www.edasol-au.com/>
- [11] <http://www.icasus-au.com/>
- [12] <http://www.emc-review.com/>
- [13] <http://www.gfpn-au.com/>
- [14] <http://www.lazagara-vlasic.net/>
- [15] <http://demo.commerceguys.com/dc/catalog/>
- [16] <http://www.drupalcommerce.org/>
- [17] <http://www.popsugar.com/community/groups>
- [18] <http://drupal.org/project/og>
- [19] www.web-apeiron.com/****
- [20] <http://drupal.org/project/cck>
- [21] <http://www.web-apeiron.com/admin/build/>
- [22] <http://drupal.org/project/ctools>
- [23] <https://www.google.com/analytics/>