

SINE - a System with Interactive acknowledgement and Evaluation of students work during laboratory sessions

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Abstract

Currently, there is a lack of tools for acknowledging and evaluating the student work during laboratory sessions. Thus, we propose a new web-interface tool, called *SINE*, which evaluates students in an interactive mode. Students and the person conducting the laboratory can both interact with the system in a controlled manner.

1 Introduction

A person conducting a laboratory session (teacher) needs to acknowledge if students are present (in the Romanian universities, laboratories are mandatory) and evaluate their work. This is usually done by keeping a record on a notebook, a simple sheet of paper or in an electronic format (e.g. text file, html page, or Excel table). The students have no access to this information, except during laboratory sessions by asking the teacher. It can happen that more students want to know their attendance status (in the Romanian universities, a student is allowed for examination only if he/she attended the laboratory sessions in proportion of 90%) or their marks. Then, the teacher will spend too much time answering them and he/she cannot fulfill to their responsibilities during that session (e.g. offering support related to the subject of that specific laboratory or evaluating completed work).

We propose a new Linux-based instrument with a web-interface that evaluates the students in an interactive mode with the help of both students and the teacher.

This web-interface can also be consulted by the students at any time. Another advantage is that this system may also gather final programs and documentation that were provided by the students. The collected files can be easily accessed by the teacher.

This paper is structured as follows. Section 2 describes the system and the way it can be used by the students and the teacher. Section 3 describes its architecture and the Linux [4] implementation details. The future work on this system along with the conclusions are provided in Section 4.

2 SINE

SINE has a web interface (see Figure 1), which includes multiple student groups to be evaluated by one teacher for one subject during one semester/year. Each group record contains a line for each student assigned to that group.

A line contains the following fields related to a student:

- a number of order within the group;
- the full name of the student;
- the subgroup he/she was assigned to;
- the number of sessions he/she attended the laboratory versus the number of sessions he/she did not attend the laboratory;
- a field for each laboratory session containing the id. number of the problem that student must complete, from a list of problems, in order to be evaluated;
- a field for the final average mark;
- a field for the mark obtained, at the end of the semester/year, during the practical examination;
- the student's login name on the mail server designated for students.

This web-page also contains a legend (i.e. an explanatory table) which lists the meaning of some coloured highlighting used. They are:

- which means that that student accumulated too many absences;

SO(1) - prezente - note															LEGENDA	
Grupele: 321 322 323 122 alte grupe															<div style="display: flex; justify-content: space-between;"> <div style="width: 40%;"> <div style="background-color: #f96; width: 15px; height: 10px; margin-bottom: 2px;"></div> prea multe absente <div style="background-color: #90ee90; width: 15px; height: 10px; margin-bottom: 2px;"></div> laboratoare predate si notate <div style="background-color: #ff69b4; width: 15px; height: 10px; margin-bottom: 2px;"></div> laboratoare predate primite pe mail <div style="background-color: #ffff00; width: 15px; height: 10px;"></div> student prezent </div> <div style="width: 50%; font-size: small;"> </div> </div>	
321																
	NUME	prez/abs	Lab2	Lab3	Lab4	Lab5	Lab6	Lab7	Lab8	Lab9	Lab10	Lab11	Lab12	MEDIA	Ex. Practic	e-mail
1	Bodea Traian Andrei	0 - 3/5	3	7.	2.	10	7	6.								bt30726
2	Buda Luciana Veronica	0 - 0/8														bl30729
3	Chereji Mirabela Carmen	1 - 7/1	5.	3.	11.	8.	5.	10.								cm30735
4	Cosma Alina Maria	2 - 8/0	11.	5.	10.	6.	5.	4.	4.							ca30739
5	Cristea Florin Cristian	1 - 8/0	10.	4.	7.	6.	7.	5.	2.							cf30740
6	Dragoste Daniel Marius	1 - 6/2	1.	11.	5.	5.	2.									dd30745
7	Drambarean George Lucian	1 - 6/2	4.	12.	1.	9.	4.									dg30746
8	Drimus Cora Daniela	1 - 8/0	14.	2.	16.	3.	3.	12.	3.							dc30747
9	Fericean Denisa Gabriela	1 - 8/0	3.	5.	6.	3.	7.	10.	6.							fd30750
10	Florian Mircea Ionut	1 - 7/1	14.	10.	16.	6.	2.	2.	7.							fm30751
11	Ghidiu Raluca	1 - 8/0	14.	2.	13.	4.	4.	3.	1.							gr30753
12	Hagan Maria Ioana	2 - 7/1	12.	2.	12.	2.	5.	5.	2.							hm30755
13	Holom Dorina Ionela	1 - 9/0	10.	6.	9.	7.	4.	8.	5.	2.						hd30758
14	Hudin Laura-Terezia	2 - 8/0	10.	3.	3.	2.	3.	9.	5.							hl30759
15	Ilie Ioana Ramona	2 - 6/2	6.	12.	11.	4.	3.	11.								il30761
16	Iordanescu-Voina Alexandra	2 - 7/1	13.	4.	1.	7.	3.	12.								ia30762
17	Ivan Florina Mihaela	2 - 7/1	9.	10.	6.	9.	6.	10.								if30765
18	Lazar Ramona Elena	2 - 5/3	13	9.	7	8	1.	3.	6.							lr30768
19	Lazea Ramona	2 - 7/1	8.	1.	12.	4.	1.	4.								lr30769
20	Mazalu Radu Traian	0 - 0/8														mr30771
21	Moldovan Daniel Arnold	2 - 7/1	12.	12.	12.	7.	5.	6.	3.							md30774
22	Oroian Corina Paula	2 - 7/1	4.	12	7.	1.	1.	13.	7.							oc30778
23	Petric Ioana Viorica	2 - 8/0	7.	8.	9.	9.	2.	1.	1.							pi30781
24	Rohan Ramona Andreea	2 - 7/1	2.	1.	10.	3.	4.	5.								rr30785
25	Serdean Raluca Maria	1 - 7/1	1.	11	4.	2.	1.1.	7.	7.							sr30787
26	Solea Victor	2 - 7/1	3.	6.	16.	10.	2.	10.								sv30790

Figure 1: SINE's web interface

- which means that that specific work has been evaluated and marked;
- which means that that specific work has been send by the student for evaluation and it is waiting to be marked;
- (the entire row coloured) which means that the student is acknowledged to be present.

There is also more information for each student, which does not appear on this first page, but can be accessed through the link on the login name of that specific user. The access to this information is restricted (see Figure 2(a)) due to the confidential nature of the information. Such information is depicted in Figure 2(b) and contains, for each session:

- the specific session subject with a link leading to the documentation and the list of problems for that subject;
- the mark for completed that task for that subject;

- an explanation regarding the mark;
- links to the program which solves the assigned task and its documentation which were sent by the student by e-mail.



(a) Password required

SO(1) - prezente - note

Rohan Ramona Andreea

	Tema	Problema	Nota	Obs.	Sources/Doc
Lab1	Comenzi Unix pentru fisiere. Comunicati: ftp, mail, telnet, ssh, Xwindow				
Lab2	Programa Shell (I)	2	10		lab2 sh documentate
Lab3	Expresii regulare. Utilitare sed si grep	1	7	2 saptamani intarziere + nesiguranta in prezentare	sed1 sh sed sed4 sh grep1 sh grep4 sh documentate
Lab4	Utilitari awk				
Lab5	Programa Shell (II)				
Lab6	Utilitari Make. Programe C de lucru cu fisiere Unix				
Lab7	Procese Unix si Windows (I)				
Lab8	Stocari de fisiere				
Lab9	Procese Unix si Windows (II)				
Lab10	Comunicati intre procesele Unix: pipe, FIFO				
Lab11	Comunicati intre procese Windows: pipe anonim si cu nume				
Lab12	Probleme client - server				
MEDIA					
Ex.					
Practic					

(b) Details about a student

Figure 2: Restricted access to confidential information

The confidential nature of this information consists in the mark (which in some

universities is considered so) and the links to the solutions provided by that student. If unprotected, the final program and the documentation may become “inspiration” material for other students assigned with the same task.

2.1 SINE used by students

A student can consult the first page to check:

- his/hers attendance status;
- the problems assigned to him/her;
- if he/she is acknowledged as being present;
- if his/hers solutions were acknowledged as being received by SINE.

A student is required to interact with SINE in order to notify that he/she is present and to submit the solutions for the completed tasks for evaluation. For that, a student must have access to the his/hers e-mail account on the e-mail server (provided by the faculty) assigned for students. Using this account, he/she must send a specific formatted e-mail (detailed at the bottom of the first page as depicted in Figure 3) in order to interact with SINE.

NOTA:

- prezenta si trimiterea laboratoarelor predate se face prin mail doar de pe conturile de studenti de pe *Linux.scs.ubbcluj.ro* (**VERIFICATI** ca numele de login corespunzator de pe ultima coloana din tabelul de mai sus sa fie cel pe care il folositi)
- formatul mailurilor acceptate este:
 - Subject:labX-Y**
 - X
 - *numarul laboratorului curent* pentru prezenta
 - *numarul laboratorului predat* pentru trimiterea laboratoarelor
 - Y
 - *numarul problemei primite* pentru prezenta
 - *numarul problemei predate* pentru trimiterea laboratoarelor
- Attachment:documentatie, surse** - doar in cazul trimiterii laboratoarelor predate
- numarul grupei in continut**
- orice mail in format diferit este ignorat
- mailurile trimise corect vor primi un mail de confirmare generat automat
- in urma mailului de confirmare este recomandata verificarea acestei pagini web pentru modificarile corespunzatoare

Figure 3: SINE’s e-mail specification

Following this instructions, a student writing a mail similar to the one depicted in Figure 4(b), should be instantly acknowledged to be present. This can be seen

as his/hers corresponding row in the SINE's web interface would be coloured in yellow as in Figure 4(c). When a student completes his task and wants to send it for evaluation he/she must compose a similar mail to the one depicted in Figure 4(a). SINE acknowledges that it received such mails by colouring the corresponding field with magenta (in the web-interface), as in Figure 4(c). The destination address for both these types of mails is the e-mail account where SINE is installed or it can be another e-mail account which can process such e-mails in order to redirect them to the final address where SINE is installed. The subject line has a strict format i.e., the keyword "lab" followed by the number of the laboratory session, followed by "-", followed by the number of the problem assigned. Any derivation from this format will not have any effect on SINE (i.e. such mails would be ignored). Mails sent as notification for task completion must also contain the "program-solution" and the documentation for it. Correct mails will be processed and SINE will make the modification corresponding to the sender as described in Section 3.

A student can only consult the restricted information by asking the teacher's assistance.

2.2 SINE used by the person conducting the laboratory

The person conducting the laboratory can also consult any information (public or restricted) from SINE's web-interface and can use auxiliary Linux tools as presented below.

→ **end_session**, which can be used after each laboratory session. It updates the number of attendances (by incrementing it) corresponding to each student acknowledged to be present. It also requests evaluation¹ for all solutions submitted by students, by using:

↔ **task_evaluation** which asks that for each solution pending for evaluation to be taken into account and eventually marked, by using:

↔ **mark_student** which asks for a mark for a specific student as an evaluation result for a specific solution presented for the assigned task.

→ **week_end** which updates the number absences for each student so that is the number of completed sessions minus the number of attendances. This is

¹Usually the student is requested to demonstrate and present his work before sending the task completion notification mail.

```

Date: Fri, 2 Jun 2006 14:14:52 +0300 (EEST)
From: Simion Iulian Ios <i107898@linux.SCS.UBBCluj.Ro>
To: Sanda Dragoș <sanda@linux.SCS.UBBCluj.Ro>
Subject: lab9-9
Parts/Attachments:
  1 Show 1 lines Text
  2 OK -1.2 KB Text, ""
  3 OK -3.6 KB Text, ""
  4 17 KB Application, ""
-----
322

[ Part 2, "" Text/PLAIN (Name: "Child.cpp") 27 lines. ]
[ Not Shown. Use the "V" command to view or save this part. ]

[ Part 3, "" Text/PLAIN (Name: "Parent.cpp") 78 lines. ]
[ Not Shown. Use the "V" command to view or save this part. ]

[ Part 4, "" Application/RTF 22KB. ]
[ Cannot display this part. Press "V" then "S" to save in a file. ]

```

(a) Mail format for evaluation pending

```

Date: Fri, 2 Jun 2006 14:19:00 +0300 (EEST)
From: Gorzan Ligia Maria <g10754@linux.SCS.UBBCluj.Ro>
To: Sanda Dragoș <sanda@linux.SCS.UBBCluj.Ro>
Subject: lab12-10
322

```

(b) Mail format for presence notification

SO(1) - prezente - note

LEGENDA

- prea multe absente
- laboratoare predate si notate
- laboratoare predate primite pe mail
- student prezent

Grupele: 321 322 323 122 alte grupe

		321														
	NUME	prez/abs	Lab2	Lab3	Lab4	Lab5	Lab6	Lab7	Lab8	Lab9	Lab10	Lab11	Lab12	MEDIA	Ex. Practic	e-mail
1	Bodea Traian Andrei	0-3/5	3	7	2	10	7	6								bt30726
2	Buda Luciana Veronica	0-0/8														bl30729
3	Chereji Mirabela Carmen	1-7/1	5	3	11	8	5	10								cm30735
4	Cosma Alina Maria	2-8/0	11	5	10	6	5	4	4							ca30739
5	Cristea Florin Cristian	1-8/0	10	4	7	6	7	5	2							cf30740
6	Dragoste Daniel Marius	1-6/2	1	11	5	5	2									dd30745
7	Drambarean George Lucian	1-6/2	4	12	1	9	4									dq30746
8	Drimus Cora Daniela	1-8/0	14	2	16	3	3	12	3							dc30747
9	Fericean Denisa Gabriela	1-8/0	3	5	6	3	7	10	6							fd30750
10	Florian Mircea Ionut	1-7/1	14	10	16	6	2	2	7							fm30751
11	Ghidiu Raluca	1-8/0	14	2	13	4	4	3	1							gr30753
12	Hagan Maria Ioana	2-7/1	12	2	12	2	5	5	2							hm30755
13	Holom Dorina Ionela	1-9/0	10	6	9	7	4	8	5	2						hd30758
14	Hudin Laura-Terezia	2-8/0	10	3	3	2	3	9	5							hl30759
15	Ilie Ioana Ramona	2-6/2	6	12	11	4	3	11								il30761
16	Iordanescu-Voina Alexandra	2-7/1	13	4	1	7	3	12								ia30762
17	Ivan Florina Mihaela	2-7/1	9	10	6	9	6	10								if30765
18	Lazar Ramona Elena	2-5/3	13	9	7	8	1	3	6							lr30768
19	Lazea Ramona	2-7/1	8	1	12	4	1	4								lr30769
20	Mazalu Radu Traian	0-0/8														mr30771
21	Moldovan Daniel Arnold	2-7/1	12	12	12	7	5	6	3							md30774
22	Oroian Corina Paula	2-7/1	4	12	7	1	1	13	7							oc30778
23	Petric Ioana Viorica	2-8/0	7	8	9	9	2	1	1							pl30781
24	Rohan Ramona Andreea	2-7/1	2	1	10	3	4	5								rr30785
25	Serdean Raluca Maria	1-7/1	1	11	4	2	1.1	7	7							sr30787
26	Solea Victor	2-7/1	3	6	16	10	2	10								sv30790

(c) Instant notification on the web interface

Figure 4: Student notifications

usually done at the end of each week because a student can attend the same session with another group (in another day of the same week) other than his own.

→ **end_semester** which generates the list of students with their final average

mark for printing or as a web-page to be posted in order to be consulted by the students. The average mark is computed for each student by using:

↔ **average mark** which based on the information from the restricted area (depicted in Figure 2(b)), computes the average mark for one specified student.

3 Implementation details

In order to be used, SINE requires an installation phase which involves the creation of the students database, the web interface, and all the other required settings as described below.

3.1 Creating the students database

This stage consists in two steps. First the list of students is created, and then this list is introduced in a database structured as specified by the teacher.

The first step must be performed on the e-mail server dedicated to students. That is because a search must be performed in `\etc\passwd` in order to make the relations between the students names within a simple list (which, in our case, can be found on the faculty webpage) to the corresponding login names. These login names would be the unique searching/indexing keys in the student database. This task is performed by a shell application called `list2loginlist.sh`. The input and output of this application are depicted in Figure 5.

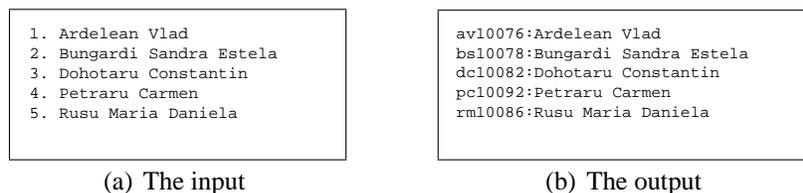


Figure 5: The input and the output of `list2loginlist.sh`

If more groups are considered, this first step will be repeated for each of them and the resulting files will be eventually concatenated.

As a second step, the “login-list” file, resulted from the first step, is structured as specified by a table heading. This shell tool is called `loginlist2db.sh`, and its output is depicted in Figure 6.

NUME	prez/abs	Lab2	Lab3	Lab4	Lab5	Lab6	Lab7	Lab8	Lab9	Lab10	MEDIA	Ex. Practic
321												
1. bt30726:Bodea Traian Andrei												
2. bl30729:Buda Luciana Veronica												
3. cm30735:Chereji Mirabela Carmen												
4. ca30739:Cosma Alina Maria												
5. cf30740:Cristea Florin Cristian												
6. dd30745:Dragoste Daniel Marius												

Figure 6: The output of *loginlist2db.sh*

This stage requires advanced bash [5], awk [3], sed [1] and grep [2] knowledge.

3.2 Creating the web interface

The text file resulted from the previous phase is now converted into an html site. The first page is created by the *txt2html.sh* tool, which results in the html file sampled in Figure 7.

SO(1) - prezente - note															
<p>Grupele: 321 322 323 122</p>															
321															
NUME	prez/abs	Lab2	Lab3	Lab4	Lab5	Lab6	Lab7	Lab8	Lab9	Lab10	Lab11	Lab12	MEDIA	Ex. Practic	e-mail
1	Bodea Traian Andrei														bt30726
2	Buda Luciana Veronica														bl30729
3	Chereji Mirabela Carmen														cm30735
4	Cosma Alina Maria														ca30739
5	Cristea Florin Cristian														cf30740
6	Dragoste Daniel Marius														dd30745

LEGENDA

- prea multe absente
- laboratoare predate si notate
- laboratoare predate primite pe mail
- student prezent

Figure 7: The output of *txt2html.sh*

Then, *restrictedDB.sh* creates for each student a directory named with the student's login name, and containing an html file like the one depicted in Figure 2(b). This directory will also contain the programs and the documentations submitted by the student for evaluation.

This web interface was created using HTML 4.01 specifications [7], and Cascading Style Sheets, level 2 revision 1 (CSS 2.1) specifications [8] for the highlights described in Section 2.

3.3 Settings for mail filtering

Processing students e-mail was done using the *procmail* [6] utility. Therefore, smaller e-mails ($< 2kB$) respecting the requested format are treated as presence mails and processed by *attendance.sh*. This shell utility modifies the appearance of the corresponding line in the web interface, by modifying its CSS style, if the specified ‘lab’ number is the same as the number of the current session. It also places the assigned problem number in the corresponding table cell and records these messages in an *attendances* text-file on the e-mail server. Larger e-mails ($> 2kB$) respecting the requested format are treated as evaluation pending mails and are processed by:

- *attachsave.sh* which extracts the attachments and save them into the directory corresponding to the sender, created in the second step of the previous stage.
- *evaluation_pending.sh* which modifies the appearance of the cell corresponding to the specified ‘lab’ (that has to be unmarked as evaluated, or pending for evaluation) for that student in the web interface, by changing its CSS style. It also records these messages in an *evaluation_pendings* text-file on the e-mail server.

4 Conclusions

Teaching computer science in high schools and universities requires computer laboratory sessions. However, there is no generic tool for collecting and evaluating students work. Therefore, in this article we proposed an interactive Linux-base instrument for student evaluation during laboratory sessions, called SINE. The instrument has a web interface that automatically records any interaction made by students or teacher during the laboratory session.

The strict formats which have to be respected for any SINE interaction also alleviate any possible errors. The system is small, robust and safe, being used by the first author for three academic semesters during *Operating Systems (I)* and *Computer Architecture* laboratories, at the Faculty of Mathematics and Computer Science of “Babes-Bolyai” University, Cluj-Napoca, Romania.

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