ON-LINE FEEDBACK: A HUMAN – COMPUTER E-COLABORATION EXAMPLE

Mile Jovanov
Institute of Informatics,
Faculty of Natural Sciences and Mathematics
Skopje, Macedonia

Marjan Gusev
Institute of Informatics,
Faculty of Natural Sciences and Mathematics
Skopje, Macedonia

ABSTRACT

In our changing world, due to the technology, many real-life processes are altered, hastened, or both. There are even newly introduced processes, not imaginable before the time of some newly developed technologies.

Collaboration is one such process and nowadays there is greater interest in the essence of the process.

Our goal in this paper is to present an example of a human-computer e-collaboration in the field of programming contests.

We present a part of the architecture of a system named MENDO, used by the Macedonian Computer Society in the organization of informatics competitions, that allows human – computer collaboration.

I. INTRODUCTION

We live in a fast changing world, due to the technology around us. Many real-life processes are altered, hastened, or both. There are even newly introduced processes, not imaginable before the time of some newly developed technologies.

Collaboration is a recursive process where two or more entities work together to realize shared goals by sharing knowledge, learning and building consensus (as defined on Wikipedia) [1]. As with other processes, the current technology development has great impact on the collaboration. A numerous collaborative tools ease the process of collaboration, giving an "e" in front of it – e-collaboration. In this way, more and more collaboration is possible. Hence, there is greater interest in the essence of the process.

While exploring the collaboration processes, it has been understood that entities in the processes are not necessarily humans. Sometimes, even a machine, or more precisely the software is included. Some researchers argue that there is a machine-machine collaboration, if we consider examples like Service Oriented Architectures and Generic Interfaces.

Our goal in this paper is to present an example of a human-computer e-collaboration in the field of programming contests.

II. COMPETITIONS IN INFORMATICS

In the past thirty years competitions in informatics are usually synonyms for algorithmic programming contests (other types include architecture, design, development, specification, assembly, testing scenarios, etc…) [2]. Many programming contests in the world use automatic grading of the contestants' solutions. This is accomplished by running them on batches of input data and testing correctness of the output. Time and memory limits are usually enforced during the process, which allows for the efficiency of the algorithm to be taken into account. [3]

A. Macedonian competitions in informatics

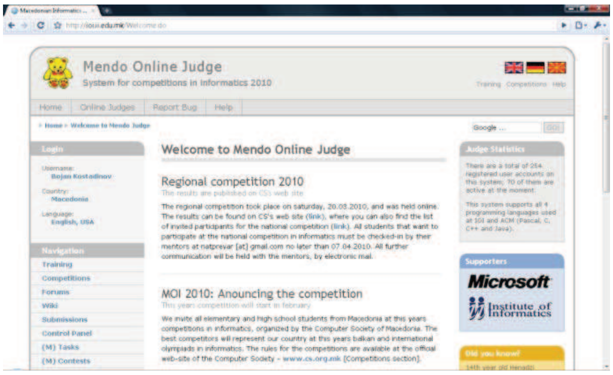
Competitions in informatics have a long tradition in Macedonia. There were XXI national contest cycles till the end of 2010. After number of competitions on national level, the best contestants represent themselves and Macedonia at IOI – International Olympiad in Informatics, BOI – Balkan Olympiad in Informatics (high school students), and JBOI – Junior Balkan Olympiad in Informatics (primary school students). [4]

B. Grading Systems

Grading systems, as traditionally referred to, nowadays are much more than that. Today, we can talk about self managed systems that completely administer contests (including gathering and grading of submissions, managing competitor's questions and clarifications, publishing results, providing statistics). Some systems provide training for students by including automated graders (which are available 24/7).

C. MENDO – The Macedonian grading system

The Macedonian grading system is named MENDO (teddy bear), as acronym for the Macedonian translation of Macedonian E-Competitions and State Olympiads (Fig. 1).



Welcome to Mendo Online Judge

Regional competition 2010

The results are published on CS's web site

The regional competition took place on saturday, 20.03.2010, and was held online. The results can be found on CS's web site (link), where you can also find the list of invited participants for the national competition (link). All students that want to participate at the national competition in informatics must be checked-in by their mentors at natprevar [at] gmail.com no later than 07.04.2010. All further communication will be held with the mentors, by electronic mail.

MOI 2010: Anouncing the competition

This years competition will start in february

We invite all elementary and high school students from Macedonia at this years competitions in informatics, organized by the Computer Society of Macedonia. The best competitors will represent our country at this years balkan and international olympiads in informatics. The rules for the competitions are available at the official web-site of the Computer Society – www.cs.org.mk [Competitions section].

There are a total of 254 registered user accounts on this system; 70 of them are active at the moment.

This system supports all 4 programming languages used at IOI and ACM (Pascal, C, C++ and Java).

Figure 1: MENDO's home page

The specific features of the MENDO System include:

- It’s one of the rare systems that operate on Microsoft Windows. Besides the fact that only a small number of grading systems operate on MS Windows, we found the OS to be very stable, reliable and easily controllable;
- MENDO easily distributes load (plugging more graders is easy, thanks to the modular architectural design of the system);
- It controls the entire system of the Computer Society of Macedonia (by providing automatic backups for itself and the other applications, self-tests of the application, the server and the operating system);
- It has multilingual support (currently Macedonian and English, but we are planning to add more languages in the near future);
- It’s managed by several administrators and moderators, each with its own privileges and responsibilities. Every moderator and administrator can add tasks, create competitions, generate reports for each task and competition, initiate system backups, etc.;
- Heavy use of AJAX to simplify user interface operations (during registration, training sessions, competitions, etc)
- MENDO was designed to be an entire gateway for algorithmic related topics (by including a news page, forum and an open wiki for publishing results, solutions & programming related materials) [5].

D. *MENDO subsystems and employment*

Besides the main system, MENDO also contains a public forum and a wiki.

Every user is allowed to post content on the wiki, and to upload materials, images and other files. Only administrators and moderators are allowed to delete content.

The forum provides an attractive interface, an efficient forum engine, an easy to use administrative panel, an advanced permission control system and much more.

Since all subsystems of MENDO use Single Sign On and automatic language detection, there is no need to change the language or login every time you switch from one subsystem to the other, since this is automatically done by the underlying system (which, as said before, is managed using cookies).

In practice, MENDO is used as:

- A training system (contains tasks from past contests, both national and international)

- A contest management system (for organizing official national competitions and open online tournaments)

- Macedonian algorithmic programming gateway, containing a news page, a lot of programming related materials (organized in a wiki), and a public forum.

III. MENDO AS TRAINING SYSTEM

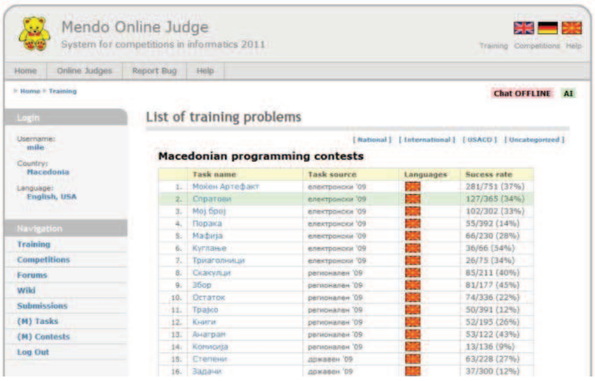
The training system incorporated in MENDO can be used 24/7.

Given the format of competitions, and especially the way of grading the solutions through test cases, the training system had to be able to provide the same kind of judging as real contest grading system.

The main and simplest idea is to copy the real grading system, and use it in the training section.

Every time a user logs in to MENDO’s web-site, he can view all the tasks that are available for training (Fig. 2), and he can submit a solution. After a solution has been submitted, the submission is added to a queue and judged as early as possible (this is no longer than 1 minute, even during heavy-load competitions).

After a submission has been judged, the results of every test case are shown to the user in a form called detailed feedback. There is no limit to the number of submissions a user can make during a time period.



Mendo Online Judge

System for competitions in informatics 2011

Username: mile

Country: Macedonia

Language: English, USA

List of training problems

[National] [International] [USACO] [Uncategorized]

Macedonian programming contests

	Task name	Task source	Languages	Sucess rate
1.	Мокен Артефакт	електронски '09	🇲🇰	281/751 (37%)
2.	Спратови	електронски '09	🇲🇰	127/365 (34%)
3.	Мој број	електронски '09	🇲🇰	102/302 (33%)
4.	Порака	електронски '09	🇲🇰	55/392 (14%)
5.	Мафија	електронски '09	🇲🇰	66/230 (28%)
6.	Куглање	електронски '09	🇲🇰	36/66 (54%)
7.	Триаголници	електронски '09	🇲🇰	26/75 (34%)
8.	Скакулци	регионален '09	🇲🇰	85/211 (40%)
9.	Збор	регионален '09	🇲🇰	81/177 (45%)
10.	Остаток	регионален '09	🇲🇰	74/336 (22%)
11.	Трајко	регионален '09	🇲🇰	50/391 (12%)
12.	Книги	регионален '09	🇲🇰	52/195 (26%)
13.	Анагрм	регионален '09	🇲🇰	53/122 (43%)
14.	Комисија	регионален '09	🇲🇰	13/136 (9%)
15.	Степени	државен '09	🇲🇰	63/228 (27%)
16.	Задачи	државен '09	🇲🇰	37/300 (12%)

Figure 2: MENDO training section

So, MENDO supports the main solution for training system, but also, provides more options.

IV. MENDO’S HUMAN – COMPUTER E-COLABORATION

In Macedonia, we have a situation where programming is very lightly included in primary and secondary school curricula. Contestants participating in the competitions are destined to learn on their own.

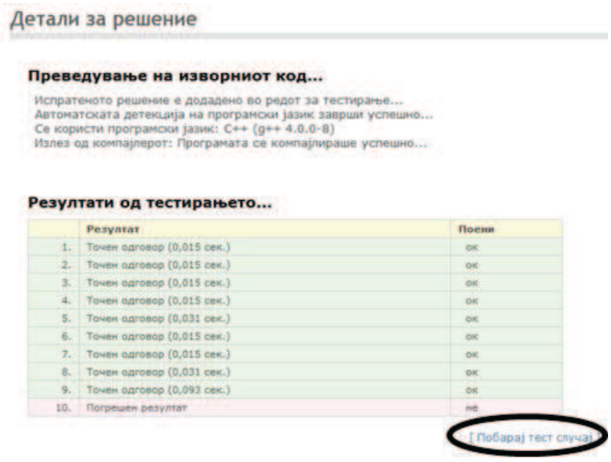
That’s why the main goal of MENDO’s training system is to motivate contestants to solve as many problems as possible, and, through that process, to gain knowledge for solving similar classes of problems. To do that, the system should aim to inspire the contestant to keep making improvements of her code, or even start over one or more times, in order to produce a complete solution graded with 100% of the points. This is not an easy task, given the other possibility that the contestant has: searching, or asking other contestants, for a complete code of the solution.

Even the main idea of unlimited number of submissions, each one provided with a feedback, reveals a kind of collaboration between the system and the contestant. But, new ideas that aim to keep the contestant’s attention solely on solving the problem offer in a way more comprehensive example of even deeper collaboration.

A. *Giving out a test case*

First implemented idea is the following: If the user’s program solution gives wrong output for one or more test cases (which can be concluded by the detailed feedback, Fig. 3), she could ask for the test case (the input that the system uses, and the expected result).

In this way, it is expected that the contestant could conclude what case is not covered by hers implemented algorithm (the solution). Then she should make the necessary changes to the solution (or even rewrite a new solution) in order to cover the mentioned test case, and also the other test cases that cover the same part.



Детали за решение

Преведување на изворниот код...

Испратеното решение е додадено во редот за тестирање...
Автоматската детекција на програмски јазик заврши успешно...
Се користи програмски јазик: C++ (g++ 4.0.0-8)
Излез од компајлерот: Програмата се компајлираше успешно...

Резултати од тестирањето...

	Резултат	Поени
1.	Точен одговор (0,015 сек.)	ок
2.	Точен одговор (0,015 сек.)	ок
3.	Точен одговор (0,015 сек.)	ок
4.	Точен одговор (0,015 сек.)	ок
5.	Точен одговор (0,031 сек.)	ок
6.	Точен одговор (0,015 сек.)	ок
7.	Точен одговор (0,015 сек.)	ок
8.	Точен одговор (0,031 сек.)	ок
9.	Точен одговор (0,093 сек.)	ок
10.	Погрешен резултат	не

[Побарај тест случај]

Figure 3: Detailed feedback for a submission

Even more, there is a restriction in demanding test cases. If one asks for a test case, she is not allowed to ask for another test case for 3 hours, hoping that this time will be used for improving the solution.

B. *Including hint(s) for a test case*

The next idea is more demanding than the previous one. It requires from the problem maker to provide some kind of hint (or hints) for every test case for the program. This is a kind of a drawback because it is little different than preparing a task for the competition. Nevertheless, the problem maker almost always, when producing test cases, has in mind what part of the task (of the solution) is checked by that test case. The additional effort will be to put that in a form of a hint, for the contestants that will use the task in the training section.

Additionally, for some test cases, more than one hint can be provided, so the contestant could get one hint at a time.

C. *Hint for a test case by a competitor*

Following the previous idea and putting in force the full potential of the human – computer collaboration, the next step is to allow a user who has solved some particular test case of the problem with hers solution, to provide a hint for that test case. There is more work to be done on determining (grading) the quality of the hint, depending on the user that provides it.

D. *Complete test case by a competitor*

Finally, a competitor that has solved the problem could be allowed to provide a test case, that she believes is essential when grading the solutions. In this way, the system will gain better set of test cases for testing the subsequent submissions.

V. Conclusion

In this paper we explained the form of programming competitions and especially the ways of grading the contestant’s solutions of the problems. We mentioned our grading system MENDO, and explained the part of the system intended for training. Through the explained approach for training, and ideas for improving and strengthening it, we provided example(s) for possible human – computer collaboration.

VI. References

[1] http://en.wikipedia.org/wiki/Collaboration, accessed in May 2011

[2] http://en.wikipedia.org/wiki/International_Olympiad_in_Informatics, , accessed in May 2011

[3] Mares M.: Perspectives on Grading Systems. Olympiads in Informatics 2007 Vol. 1. pp. 124-130 (2007)

[4] http://www.cs.org.mk/, official web-site of the Computer Society of Macedonia

[5] B. Kostadinov, M. Jovanov, E. Stankov: „A New Design of a System for Contest Management and Grading in Informatics Competitions“, ICT Innovations Conference 2010