

Feasibility Study on Logging User Activity in an Interactive Mathematics System

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Abstract:

ISAC is a system for applied mathematics. This document is a report about the work done in my master practical within the *ISAC*-team.

The main goal of my project was to design and implement a system for logging user activity in *ISAC*. The second was to do a feasibility study on interaction between *ISAC* and different E-Learning systems, such as CompOD or Moodle. In this case *ISAC* should be able to ask a web-service to propose the next most suitable example for the user.

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Chapter 1

Technical Issues

This chapter describes the technical issues for logging user activity and further the premises to connect *ISAC* to an E-Learning application via a web-service.

1.1 Database Model

The database model 1.1 consists of two tables:

- UserLogger: Contains the data that represents the user activity. This data is used for the queries, that are described later in this document.
- UserTest: This table is only used in a few unit-tests for checking the connection to the database and should never be changed.

| Physical Data Model | |
|---------------------|--------------------|
| Model: | ISAC |
| Package: | |
| Diagram: | ISAC_UserLog |
| Author: | Christian Ropposch |
| Date: | 30.07.2007 |
| Version: | 1.0 |

| UserLogger | | | |
|----------------------|--------------|------|----------|
| <u>UserLogger_id</u> | int | <pk> | identity |
| UserName | varchar(25) | | not null |
| Session | varchar(25) | | not null |
| Dialog | varchar(50) | | null |
| Step | varchar(50) | | null |
| Time | timestamp | | not null |
| Worksheet | varchar(250) | | null |
| Position | varchar(50) | | null |
| FormulaFrom | text | | null |
| FormulaTo | text | | null |
| Argument | varchar(250) | | null |
| Substitution | varchar(250) | | null |
| Success | float | | null |

| UserTest | | | |
|--------------------|-------------|------|----------|
| <u>UserTest_id</u> | int | <pk> | identity |
| TestValue | varchar(25) | | not null |

Figure 1.1: Database model for logging user activity

1.2 Class Diagram

The class diagram 1.2 shows only the classes which are necessary to implement the functionality of logging the user activity.

- **UserRecord:** Holds the data that is saved into the database by the class **UserLogger**.
- **UserLogger:** Holds the member functions that are responsible for storing the user-data in the database.

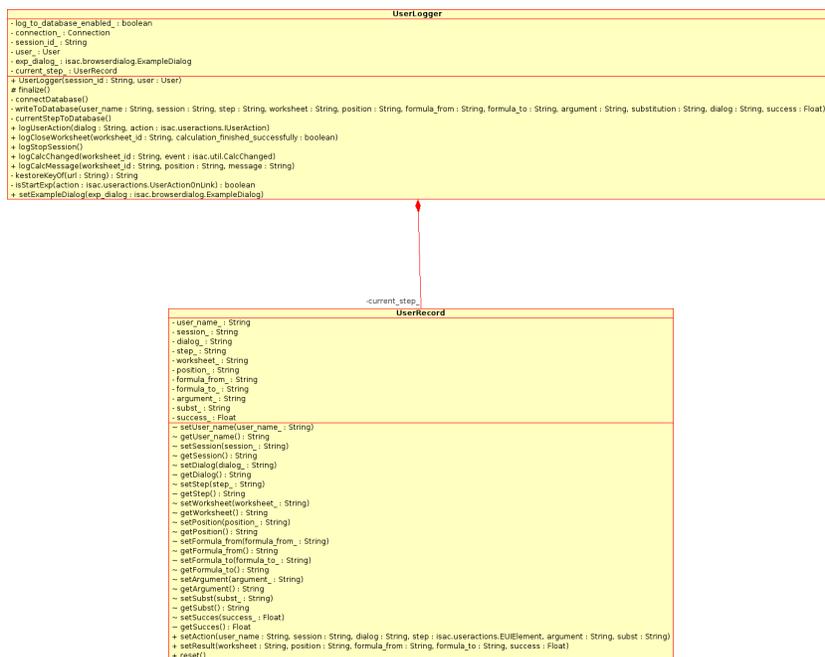


Figure 1.2: Class diagram for logging user activity

1.3 Queries / Statistics

This section gives an overview of already implemented queries to check the activities of the *ISAC*-users.

1.3.1 Query 1

Which users had used *ISAC*? 1.3

Listing 1.1: SQL Listing of Query 1

```

1  select UserName, Argument as UserUrl, Time as Begin,
2  unix_timestamp((select Time from UserLogger
3  where step='UL.STOP_SESSION' and session=ul1.session))
4  - unix_timestamp(ul1.time) as Duration,
5  (select count(*) from UserLogger where step='LO.OPEN.WORKSHEET'
6  and session=ul1.session) as Examples
7  from UserLogger ul1
8  where step='LO.START_SESSION';

```

| UserName | UserUrl | Begin | Duration | Examples |
|----------|---------------|-----------------------|----------|----------|
| x | TODO user-url | 2007-10-26 12:00:06.0 | | 1 |
| htl | TODO user-url | 2007-10-26 12:01:45.0 | 211 | 1 |

Figure 1.3: Sample output of Query 1

1.3.2 Query 2

Which examples has a user calculated over all his sessions? 1.4

Listing 1.2: SQL Listing of Query 2

```

1  select session, Argument as ID, FormulaTo as Example, Time as Begin,
2  unix_timestamp((select Time from UserLogger where step='LO.STOP.EXAMPLE'
3  and session=ul1.session limit 1)) - unix_timestamp(ul1.time) as Duration,
4  (select Success from UserLogger where step='LO.STOP.EXAMPLE'
5  and session=ul1.session limit 1) as Success,
6  (select count(*) from UserLogger where step like 'UL.SOLVE%'
7  and session=ul1.session limit 1) as Calc_Steps,
8  (select count(*) from UserLogger where step not like 'UL.SOLVE%'
9  and session=ul1.session limit 1) as Other_Steps
10 from UserLogger ul1
11 where UserName='x' and Step='LO.OPEN.WORKSHEET';

```

| Session | ID | Example | Begin |
|---------|---------------------------|-------------------------------|-----------------------|
| 0 | exp_IsacCore_Tests_1a.xml | solve (1 + -1 * 2 + x = 0, x) | 2007-10-26 12:00:56.0 |
| 2 | exp_IsacCore_Tests_1b.xml | solve (x + 1 = 2, x) | 2007-10-26 12:38:15.0 |

| Duration | Success | Calc_Steps | Other_Steps |
|----------|---------|------------|-------------|
| 7 | 1.0 | 4 | 3 |
| 5 | 1.0 | 2 | 4 |

Figure 1.4: Sample output of Query 2

1.3.3 Query 3

What did a user do during a certain session? 1.5

Listing 1.3: SQL Listing of Query 3

```

1  select Dialog, Step, Time, Worksheet, Position, FormulaFrom,
2  FormulaTo, Argument, Substitution, Success

```

```

3 from UserLogger
4 where Session=0
5 order by Time;

```

| Dialog | Step | Time | Worksheet | Position |
|-----------|------------------------|-----------------------|-----------|-----------|
| | LO_START_SESSION | 2007-10-26 12:00:06.0 | | |
| exp | LO_OPEN_WORKSHEET | 2007-10-26 12:00:56.0 | 0_0 | ([],Pbl) |
| worksheet | UI_SOLVE_CALCULATE_1 | 2007-10-26 12:00:59.0 | 0_0 | ([],Met) |
| worksheet | UI_SOLVE_CALCULATE_1 | 2007-10-26 12:01:00.0 | 0_0 | ([1],Frm) |
| worksheet | UI_SOLVE_CALCULATE_1 | 2007-10-26 12:01:01.0 | 0_0 | ([1],Res) |
| worksheet | UI_SOLVE_CALCULATE_ALL | 2007-10-26 12:01:03.0 | 0_0 | ([2],Res) |
| worksheet | LO_STOP_EXAMPLE | 2007-10-26 12:01:03.0 | 0_0 | |

| FormulaFrom | FormulaTo | Argument | Substitution | Success |
|-------------------------------|-------------------------------|---------------------------|--------------|---------|
| | | TODO user-url | | 0.0 |
| solve (1 + -1 * 2 + x = 0, x) | solve (1 + -1 * 2 + x = 0, x) | exp_IsacCore_Tests_1a.xml | | 1.0 |
| solve (1 + -1 * 2 + x = 0, x) | 1 + -1 * 2 + x = 0 | | | 1.0 |
| 1 + -1 * 2 + x = 0 | x = 0 + -1 * (1 + -1 * 2) | | | 1.0 |
| x = 0 + -1 * (1 + -1 * 2) | x = 1 | | | 1.0 |
| x = 1 | [x = 1] | | | 1.0 |
| | | | | 1.0 |

Figure 1.5: Sample output of Query 3

1.3.4 Query 4

What did a user do during a certain example? 1.6

Listing 1.4: SQL Listing of Query 4

```

1  select Dialog, Step, Time, Worksheet, Position, FormulaFrom,
2  FormulaTo, Argument, Substitution, Success
3  from UserLogger
4  where Worksheet='1.0'
5  order by Time;

```

| Dialog | Step | Time |
|-----------|----------------------|-----------------------|
| exp | LO_OPEN_WORKSHEET | 2007-10-26 12:01:53.0 |
| worksheet | UI SOLVE CALCULATE 1 | 2007-10-26 12:02:23.0 |
| worksheet | UI SOLVE CALCULATE 1 | 2007-10-26 12:02:24.0 |
| worksheet | UI SOLVE CALCULATE 1 | 2007-10-26 12:02:25.0 |
| worksheet | UI SOLVE CALCULATE 1 | 2007-10-26 12:02:27.0 |
| worksheet | UI SOLVE CALCULATE 1 | 2007-10-26 12:02:28.0 |
| worksheet | UI SOLVE CALCULATE 1 | 2007-10-26 12:02:28.0 |
| worksheet | UI SOLVE CALCULATE 1 | 2007-10-26 12:02:29.0 |
| worksheet | UI SOLVE CALCULATE 1 | 2007-10-26 12:02:30.0 |
| worksheet | UI SOLVE CALCULATE 1 | 2007-10-26 12:02:32.0 |
| worksheet | UI SOLVE CALCULATE 1 | 2007-10-26 12:02:32.0 |
| worksheet | LO_STOP_EXAMPLE | 2007-10-26 12:02:32.0 |

| FormulaFrom | FormulaTo | Argument |
|-----------------------|-----------------------|---------------------------|
| solve (x + 1 = 2, x) | solve (x + 1 = 2, x) | exp IsacCore Tests 1b.xml |
| solve (x + 1 = 2, x) | x + 1 = 2 | |
| x + 1 = 2 | x + 1 + -1 * 2 = 0 | |
| x + 1 + -1 * 2 = 0 | -1 + x = 0 | |
| -1 + x = 0 | solve (-1 + x = 0, x) | |
| solve (-1 + x = 0, x) | -1 + x = 0 | |
| -1 + x = 0 | x = 0 + -1 * -1 | |
| x = 0 + -1 * -1 | x = 1 | |
| x = 1 | [x = 1] | |
| [x = 1] | [x = 1] | |
| [x = 1] | [x = 1] | |

Figure 1.6: Sample output of Query 4

1.3.5 Query 5

How difficult are the example? 1.7

Listing 1.5: SQL Listing of Query 5

```

1  select Dialog,
2  select Argument as ID, FormulaTo as Example, Success,

```

```

3 Success-1 as Failure
4 from UserLogger
5 where Step='LO.OPEN.WORKSHEET'
6 order by Success, Failure;

```

| ID | Example | Success | Failure |
|---------------------------|-------------------------------|---------|---------|
| exp_IsacCore_Tests_1a.xml | solve (1 + -1 * 2 + x = 0, x) | 1.0 | 0 |
| exp_IsacCore_Tests_1b.xml | solve (x + 1 = 2, x) | 1.0 | 0 |
| exp_IsacCore_Tests_1b.xml | solve (x + 1 = 2, x) | 1.0 | 0 |

Figure 1.7: Sample output of Query 5

1.3.6 Query 6

Who are the most frequent users of *ISAC*? 1.8

Listing 1.6: SQL Listing of Query 6

```

1 select UserName, Argument as UserUrl,
2 (select count(*) from UserLogger where step='LO.OPEN.WORKSHEET'
3 and session=ul1.session limit 1) as Examples,
4 (select Success from UserLogger where step='LO.STOP_EXAMPLE'
5 and session=ul1.session limit 1) as Success,
6 (select count(*) from UserLogger where step like 'UI.SOLVE%'
7 and session=ul1.session limit 1) as Calc_Steps,
8 (select count(*) from UserLogger where step not like 'UI.SOLVE%'
9 and session=ul1.session limit 1) as Other_Steps
10 from UserLogger ul1
11 where Step='LO.START_SESSION'
12 order by Examples, UserName;

```

| UserName | UserUrl | Examples | Success | Calc_Steps | Other_Steps |
|----------|---------------|----------|---------|------------|-------------|
| htl | TODO user-url | 1 | 1.0 | 10 | 4 |
| x | TODO user-url | 1 | 1.0 | 4 | 3 |
| x | TODO user-url | 1 | 1.0 | 2 | 4 |

Figure 1.8: Sample output of Query 6

Bibliography