WEB-SYNDIC

Web System for Demonstrating the Syntactic Algorithms for Solving Linear Equations in Nonnegative Integers (Nonnegative Linear Diophantine Equations)

PROJECT METRICS
Iteration 2.0

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1 Introduction

The Web-SynDic project is a student software engineering (SE) project of the Petrozavodsk State University (PetrSU), Department of Computer Science (CSDept).

The project is related to the research done at CSDept of PetrSU in development of a new type of algorithms for efficient solving some classes of nonnegative linear Diophantine equations (NLDE) by syntactic (parsing) methods. These syntactic algorithms seem to be promising tool for solving some classes of NLDE system; more exactly a class of NLDE system, associated with formal grammars (ANLDE systems). For this class the syntactic algorithms allow efficient (polynomial and pseudo-polynomial) computations comparing with the general NLDE case when the same computational problems are NP-complete or even overNP.

The general goal of the project is to develop a full function web system for visual demonstrating and testing the syntactic algorithms via the Internet. This allows researchers to input ANLDE systems (manually or automatically generated), search their Hilbert bases, test the correctness of the found solution, estimate the resource consumption, and compare the efficiency with available solvers, different from syntactic.

All development process can be divided on two stages: development of the first working version of the Web-SynDic system (was finished at 2003.20.12) and development of the first working public version (was finished in November, 2004).

1.1 Document overview

In this document the key metrics of the second stage (first working public version) of the Web-SynDic Project are introduced. They make a summary quantitative and view on the project size and its other characteristics.

The second stage project schedule is presented in section 2. This presents second stage overall division of the project process into phases and the corresponding time resources.

Human resources are described in section 3. This presents how much human-hours were spent for the second stage of the project.

Section 4 gives the size of the developed software. Standard metrics in LOC and KB are used.

According to SE standards the project produced several important documents. The size of documentation in pages is given in section 5.

The important testing metrics are presented in section 6. This includes the division of the testing phase into subphases, number of executed tests and ratio of uncovered errors.

Section 7 describes the size of the project CVS repository, which stores all project-related data.

2 Project schedule

The waterfall model was chosen for the software process. The start point of the Project is 7.07.2003; at this date the planning phase was initiated. The real development process started at the first meeting, 16.07.2003.

The project schedule divided into the 3 following parts:

- Development of the first working version of the Web-SynDic system.
- Collection of implementation errors.
- Correction of main implementation errors and publication of the system.

The last part of the project schedule contains the following phases:

0. Initial planning (01.07–03.08.2004). Collection of the implementation errors and Customer requests for improvements.

Main artifacts:

- List of improvements.

1. Requirements analysis (03.08–09.08.2003). Analysis of the problem domain and user requirements.

Main artifacts:

- Requirements specification. Iteration 2.0 (first release)

2. Design (03.08–19.08.2003). Classification list of Customer improvements, design, collection of validation tests.

Main artifacts:

- Requirements specification. Iteration 2.0 (second release)
- Design. Iteration 2.0 (first release)
- Test collection. Iteration 2.0

3. Implementation (09.08–23.08.2003). Fix errors and improve the system.

Main artifacts:

- Design. Iteration 2.0 (second release)
- Test Execution Document. Iteration 2.0 (first release)

4. Testing (16.08–30.08.2003). Testing fixes and improvements.

Main artifacts:

- Test Execution Document. Iteration 2.0 (second release)

5. Alpha testing (23.08–31.10.2003).

Main artifacts:

- Test Execution Document. Iteration 2.0 (final release)

5. Publication (23.08–15.11.2003).

Main artifacts:

- User Manual. Iteration 2.0
- Project Metrics. Iteration 2.0

5. Transfer of authority (15.11.2003).

Main artifacts:

- Web-SynDic system. Version 1.0

The beta testing starts after publication.

Figure 1 sums up the Web-SynDic project schedule as Gantt diagramm.

3 Human Resources

3.1 Iteration 1

This section describes human resources (in working hours) spent for each process phase of the Web-SynDic project during the first iteration. The main phases are Requirements analysis, Design, Implementation, and Testing.

There were 6 developers at the beginning of the project. From November'2003 till the end of the first iteration there are 4 developers.

The human resources are calculated using personal working hours of each developer. The summary consumption of human resources in hours during the first iteration is shown in Figure 2. The testing phase does not include working hours spent by external testers for alpha-testing (students, researches, and other volunteers).

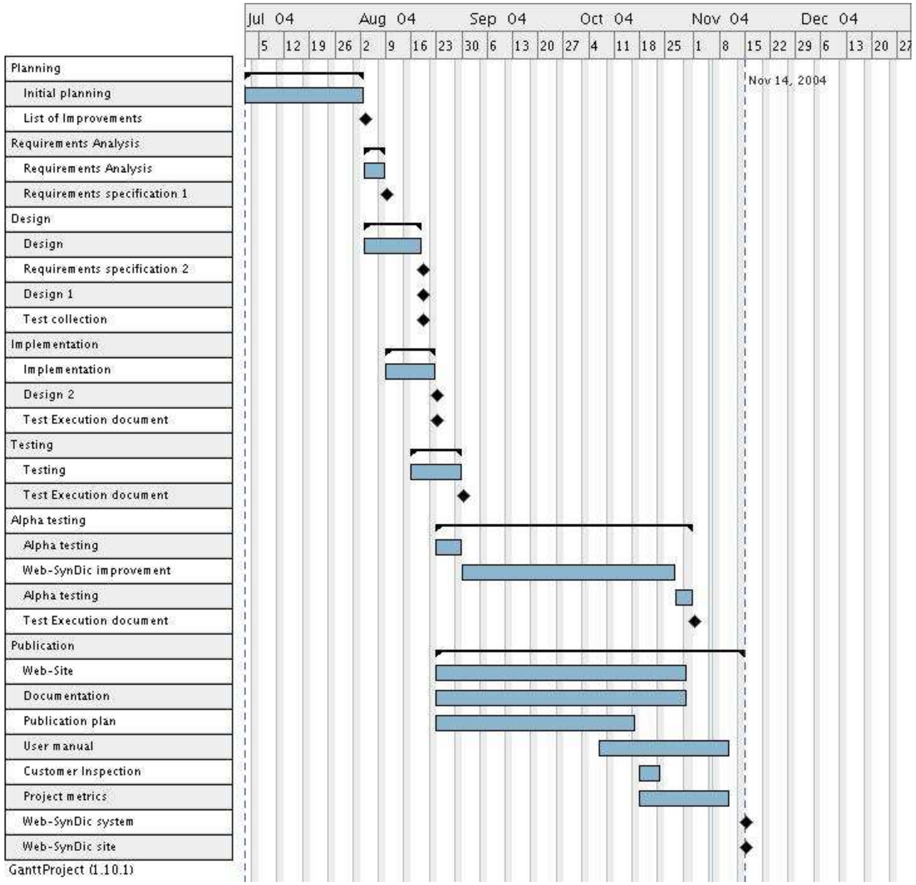

Figure 1: Gantt diagram of the project schedule

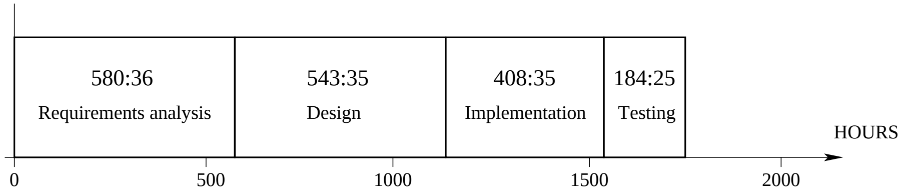

Figure 2: Working hours summary (iteration 1)

3.2 Iteration 2

This section describes human resources (in working hours) spent for each process phase of the Web-SynDic project during the second iteration. The main phases are Requirements analysis, Design, Coding, and Testing. The section also contains information on human resources spent for Meetings, writing Documentation, and Other project related activities.

There were 4 developers during the second iteration.

The human resources are calculated using personal working hours of each developer. The sum consumption of human resources in hours during the second iteration is shown in Figure 3. The testing phase does not include working hours spent by external testers for alpha-testing (students, researches, and other volunteers).

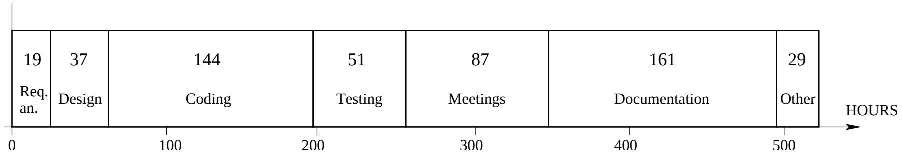

Figure 3: Working hours summary (iteration 2)

4 Software Size

This section presents size metrics of the produced software - first public version of the Web-SynDic. Table 1 contains size values for each subsystem in lines of code (LOC) and its relative contribution (%) as well as the total size of the whole software system.

Note, that the size of JSP pages is calculated in total lines of code. All JFlex an Byacc/J files are interpretered as Java files. Lines is total number code lines. Blank is number of blank-lines. Comments is number of comment lines and NCSL is number of non-comment source code lines.

Totally the software consists of 56 Java files or 247 KB, 26 JSP files or 91 KB.

In particular, this table shows that the most complex subsystems are Web-server and Algorithm-server. Obviously, these subsystems are the most important for the application and their sizes confirms this fact.

5 Documentation Size

The documentation size of the second development stage produced by the project and the corresponding time consumption ia shown in Figure 4. The X-axis represents time spent for the phases, the Y-axis corresponds to the amount of produced document pages during a phase.

There was no implementation document, because code was only changed.

Note, that the User manual is the mostly big document, because it is one of the main parts of the web-system documentation. User manual is very important for customer and future users for unerstanding.

6 Testing Size

In this section metrics for main testing subphases are introduced. This includes the number of executed tests and the number of found error/defects in the software. The metrics are shown in Table 2.

The low percent of uncovered errors shows the design was developed sufficiently and the inspection process was perfomed on an appropriate level.

7 Project CVS Repository Size

The Concurrent Versions System (CVS) was used to store all data related to the project.

Table 1: Size of code and relative effort metrics for the Web-SynDic system

Subsystem	**Program. language**	**Lines**	**Blank**	**Comments**	**NCSL**	**%(NCSL)**
Web-server and Session processing	Java	3283	600	654	2067	26
Web-server and Session processing	JSP	2765	-	-	-	34
Algorithm server	Java	3805	491	1275	2207	27
Data store	Java	488	68	147	303	4
Management	Java	775	96	328	356	4
Statistics	Java	871	101	353	423	5
Total size		11907	**1356**	**2757**	**5356**	**100 %**

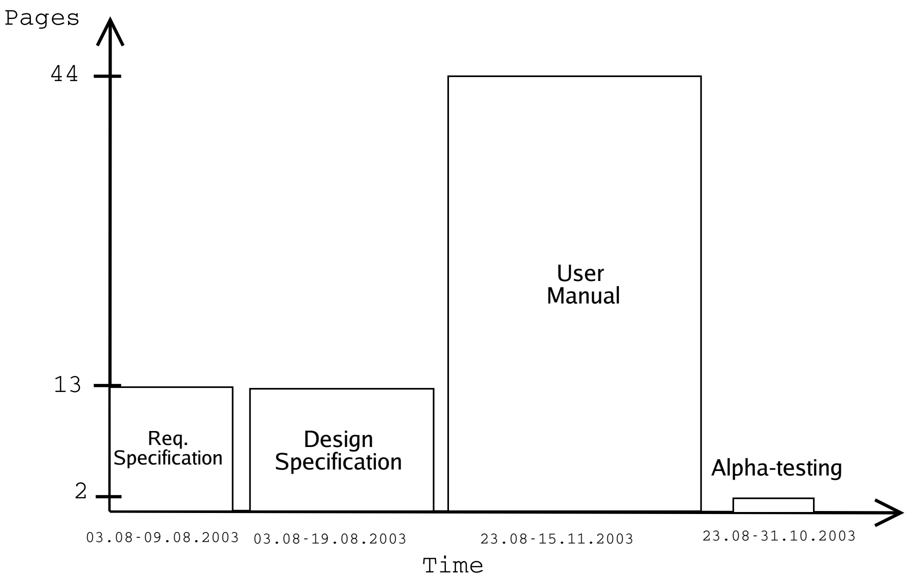

Figure 4: Metrics for documentation size

Table 2: Metrics for the testing phase

Testing subphase	**Number of tests**	**Errors found**	**Errors/Tests**
Unit testing	217	37	17%
Integration testing	117	25	21%
Total: unit & integration	334	62	19%
Alpha (stage 1)	58 students × 1.5 hours = 15 flaws found		
Alpha (stage 2)	30 flaws found (30 fixed) 16 suggestions for improvement (10 implemented)		

Total size of the repository after two project iterations is **89 MB**. This includes all versions of documentation (English and Russian branches), code (Java and JSP), executable external algorithms, test supplementary data (input, output, drivers, stubs), and CVS management data.