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ASSIGNMENTS WORKFLOW IN LEARNING MANAGEMENT SYSTEM

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Abstrakt

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Kľúčové slová: jedno, druhé, tretie

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TODO

MH: Write the introduction, ok? MH: This is a minor problem

Part I

Background

Chapter 1

MVC and HMVC design patterns

For software to be usefult, it has to interact with something. This could be another computer or process, or the interaction could be with people. So, there are interfaces. In modern applications, more effort often goes into development of usable interface than in other tasks. On the other side, our software needs to acces and store its data and perform operations on them. Purpose of this chapter is, at first, to explain MVC design patter, which is a simple and widespread way for solving this problem, then we will focus on extension of this pattern, HMVC. Both patterns are crucial to understand for purposes of this work.

1.1 Model-View-Controller

In an Object oriented programming (OOP) programmers often run into problems with application complexity and maintanance of code. As application becomes larger and more robust, it is ofter harder to add or modify existing features. Modifying of complex classes and unclear implementation can cause a lot of software bugs. On the other way, design patterns aim to provide reusable soulutions of common problems in software engineering and reduce this complexity by splitting functionality into specific classes with a single purpose. One of the most important desing patterns is Model View-Controller, which is the performs as the core of the CodeIgniter framework, which we will discuss later.

Model-View-Controller (MVC) design pattern was first created in 70's by SmallTalk programmers. Since that time, MVC design idiom has become a commonplace, especially in object oriented systems [3]. Motto of this pattern is specified as to "Stop data, program logic and presentation layers being mixed up together".

To do so, MVC has to split application functionality into three layers: models,

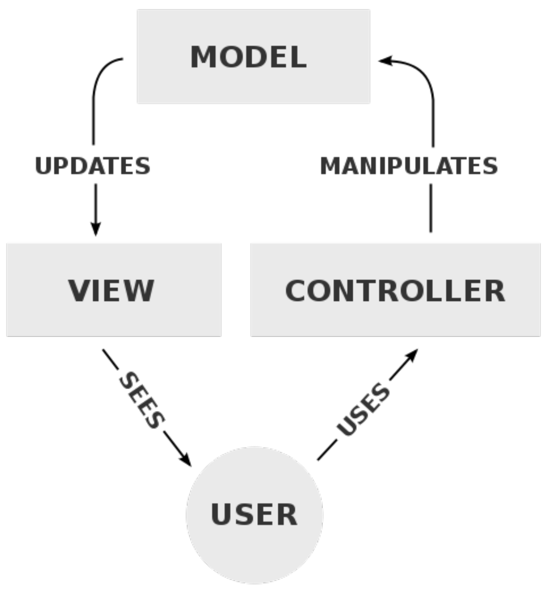


Figure 1.1: Model-View-Controller

views and controllers. Each part plays specific, distinctive, non-overlapping function. This also enables programmers to easily replace these layers and extend functionality. Now, let's look at each layer.

1.1.1 Model

The model is where all the business logic of an application is kept [10]. This can mean anything from usage of third-party services via APIs to database access in order to fulfill applications business requirements. If applications needs to read or write any data, all the operations must be performed in this layer. For purposes of this work, models will mostly contain CRUD (Create-Read-Update-Write) operations with Courses database tables in PosgreSQL.

1.1.2 View

The view, as opposed to model, is where all of the user interface elements are kept [10]. Very important rule is that models are just templates without any logic whatsoever. For purposes of our work, views will be only PHP templates, which directly generates HTML, CSS and JavaScript responses.

1.1.3 Controller

And finally, the controller is the component that connects models and views together [10]. Over-simplifying a bit, controller knows all the enviroment settings (operating system, display resolution, ...) and according to these loads data from models, performs operations with them and then the results are sent to a view. Controller knows the views but views does not. The same applies to models.

1.2 HMVC design pattern

Using MVC design pattern is excellent for building small applications. Hovewer, huge application building on pure MVC pattern brings also some disadvantages [2]. For example, large sets of views, models and controllers could be a point of confusion and failure for many programmers. In case of larger projects, it is very needed to bring order to MVC. Solution to this problem can be Hierarchical Model-View-Controller design pattern (HMVC) [8].

Hierarchical Model-View-Controller design pattern (HMVC) is a direct extension of the MVC pattern that aims to solve mainly scalability issues mensioned earlier. HMVC was first described in a blog post entitled HMVC: The layered pattern for developing strong client tiers on the JavaWorld web site in July 2000 [8]. In summary, HMVC is a collection of MVC triads operating as one application. Each of this triads is treated as individual and can be rendered on it's own. This resolves into greater scalability, code reusability and most importantly, resolves the problem with hudge views in large projects.

To successfuly implement HMVC, it is crucial for application to be broken into systems [8]. Each system gets it's own views, models and controllers and is fully in control of it's own part and nothing else. In Courses 2 system, these systems are called modules, which we will discuss later. One of the advantages of using HMVC design pattern is, that we can focus on one module without changing implementation in others.

As understanding of design patterns is needed but not considered main focus of this work, we leave any further explanations to Jakub Culik's work [2].

Chapter 2

CodeIgniter framework

CodeIgniter is an Application Development Framework - a toolkit - for people who build web sites using PHP [6]. One of it's goals is to provide exceptional performance of web applications along with minimum complexity and fast development. CodeIgniter was born from ExpressionEngine [5] in 2006 and since then, it increasingly gained popularity among PHP developers. In 2008 CodeIginiter became industry leader in an enviroment saturated with PHP frameworks [5] and in 2014 CodeIgniter v 2.2 was released.

This framework is licensed under custom Elislab license, which is basicaly an open source license with only a few restrictions [7]. We provide a copy of this license in medium attached to this work.

In this chapter, we will present a short guide of CodeIgniter request and response processing. Full user-guide and documentation can be found on CodeIgniter official website [6].

2.1 Request and response flow

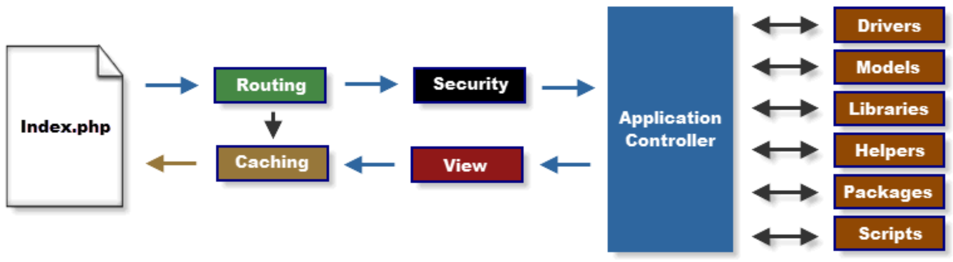


Figure 2.1: CodeIgniter request flow

To understand how CodeIgniter works, let's look at processing of HTTP requests in this framework. CodeIgniter uses Apache2 module `mod rewrite`. This allows to be firstly processed `index.php` file as seen on image 2.1. Purpose of this script is to load configuration of whole application, load routes, cache and other classes. It is provided by CodeIgniter framework and should not be changed (only for configuration purposes).

To process HTTP request, router must decide correct operation over it. If a cache file exists, it is sent directly to the browser, bypassing the normal system execution [6]. Before the application controller is loaded, the HTTP request and any user submitted data is filtered for security.

In the next step, routing takes place. Each module of application must have it's own routes defined as follows:

Listing 2.1: CodeIgniter routing

```
$route[course/(:num)] = "courses/$1";
```

The application takes list of all routes and applies the one of which regexp pattern matches the request URL. After this operation, proper controller (that must extend `CI_ CONTROLLER` class) is selected, instanciated and method `run()` of this controller is run.

This controller loads data from models, can perform some operations over them and then data are sent directly to view. The finalized View is rendered then sent to the web browser to be seen. If caching is enabled, the view is cached first so that on subsequent requests it can be served instantly.

2.2 Configuration and loading

CodeIgniter also adds support configuration classes. These classes are located in `application/config` folder with possibility of creating multiple application enviroments. We have defined three of these enviroments, each for a different purpose: development(`localhost`), test (`devcourses.matfyz.sk`) and production (`courses.matfyz.sk`) . In this configs, all settings for database access, Oauth, PHP interpreter and other enviroment dependent variables must be located.

Listing 2.2: Database configuration for development enviroment

```
$db['default']['hostname'] = 'localhost';
$db['default']['username'] = 'root';
$db['default']['password'] = 'root';
```

```
$db['default']['database'] = 'courses';
$db['default']['dbdriver'] = 'mysql';
$db['default']['dbprefix'] = '';
```

Another important feature of CodeIgniter is autolading of resources. Major drawback of development in PHP is that application must be instantiated, interpreted and run each time for every request. For optimalization purposes, we do not want each time to instantiate all of the application classes, just the ones we need. Also, it is often annoying to import many classes in controllers or models. Elegant solution for these problems is resource autoloading, which is provided as a CodeIgniter core functionality. In `config/autoload.php` we can specify all classes or paths we want to autoload and CodeIgniter will import them when application needs them.

2.3 Demonstration of Model-View-Controller

Now that we have enough knowledge of CodeIgniter background processing, we can focus on development. In this section, we will provide examples and demonstrate development in this framework.

2.3.1 Model

We cannot start explaining models without writing about active records. CodeIgniter uses a modified version of the Active Record Database Pattern. This pattern allows information to be retrieved, inserted, and updated in your database with minimal scripting. In some cases only one or two lines of code are necessary to perform a database action. CodeIgniter does not require that each database table be its own class file. It instead provides a more simplified interface. [6] This interface might seem similar to many ORM mappers.

Listing 2.3: Article model

```
class Article_model extends CI_Model
{

    function __construct()
    {
        parent::__construct();
    }

    function get_article($id)
    {
        return $this->db->from('article')
            ->where('id', $id)
            ->get()
            ->result_row();
    }
}
```

As we can see on listing 2.3, each model has to extend `CI_Model` class, which is the base class for each model and provides active records functionality. We also can not forget to call `parent::__construct()` in our constructor.

This is just an example of very simplified model, whose only purpose is to load one article with specified `id` from database. This file should be located in folder `application/models` and named `article_model.php`. Now, let's focus on views.

2.3.2 View

Listing 2.4: Article view

```
<html>
  <head>
    <title>Article page</title>
  </head>
  <body>
    <h1>Article says:</h1>
    <div>
      <?php $article->content ?>
    </div>
  </body>
</html>
```

All views are placed in `application/views` folder. Views are mostly HTML files with some PHP formatting code. We do not put any logic inside views. As we said, this view is just HTML with one PHP variable inside. How can we fill this variable? This is the time, when controller steps in.

2.3.3 Controller

Controllers must extend `CI_CONTROLLER` class. It is a base class which provides basic functionality for application management, such as view and models loading, routing or request/response management. To put our example to work, we have to write a controller like this:

Listing 2.5: Article controller

```
<?php

class Article extends MY_Controller
{
    function __construct()
    {
        parent::__construct();
    }

    function show()
    {
        $id = $this->uri->segment(3);
        $article = $this->article_model->get_article($id);
        $this->layout->set_content('views/article_view', array('article' => $article)
            ;
    }
}
```

Now, let's explain what we did in listing 2.5. At first, we had to make a `__construct` method with `parent` call. This will instantiate controller basic functionality. In method called `show()` we at first got an ID of article. This ID comes from accessed URL. Full URL route to this controller would be `domain.com/article/show` where `:id` serves as specified ID. In the next step we used call from our model, which is autoloaded and then we filled this data to our view. And voila, building applications with CodeIgniter is simple!

Chapter 3

Courses 2 LMS

Now, that we have understaning of how CodeIgniter works, we can continue with description of Courses 2 system, as it was developed by Jakub Culiks work [2]. Motivation of this chapter is to describe this system as it was implemented before this work, explain motivation for creating a new learning management system (LMS) and bring some technical details of Courses 2 LMS. This chapter is considered as an introduction to our work and may be used to differentiate our work from previous works.

3.1 Motivation

Courses 2 system was developed during spring and winter of 2015 with development team led by Jakub Culik. This team was able to create a simple, customizable and modular learning management system which is already used at our faculty. Until the end of summer semester of 2016, 32 courses with total of 200 students were using this system.

Need for this system started in 2010, when a new aproach of the learning was introduced in the web design course at our faculty [2]. Each student had to publish a multiple blog posts which where then evaluated by his classmates and teachers of the course. Ratings were then projected into his final grade from this course. This approach led students to study more about topics they were interested in and were related to this subject. With this approach, students were also forced to discuss these problems and got greater insight into blog topics.

Used blog portal `blog.matfyz.sk` was also developed at our faculty in 2008 by Martin Rejda [11], so there were many options improve this system and to modify it to our needs. For example, blog portal was modified to allow students to implement and submit their own blog layout in XSLT. Hovewer, there were still some missing features like system for reviewing of these blog articles and discussions so the need for another system arose [2]. As a solution, new system, Courses was created [1].

This system was developed as a part of bachelor's thesis in 2013 [1] and was running 4 courses for one year [2]. After this time, it seemed clear that this system has to be completely redesigned and implemented from scratch. A new system had to be modular, scalable and well designed. And so, Courses 2 was born.

3.2 Semantics

Courses 2 system architecture can be divided into two parts: system part and modules. This division is required for maintaining this system modular and scalable. Now, let's look at each part.

3.2.1 System

System part is mostly responsible for "background stuff". Models and controllers extend standard CodeIgniter classes and there is only a few standalone libraries. All files of this part are located in `application/` folder and comply with standard CodeIgniter MVC flow. All libraries of system part are loaded once on each request.

Main goal of this part is to share all data to every component. For example, after user login, user information have to be avaible for each module. Since Course and Layout information are shared too, it is placed here as well. This part is also responsible to decide which modules has to be run on specific request and printing their outputs on the correct place in application layout.

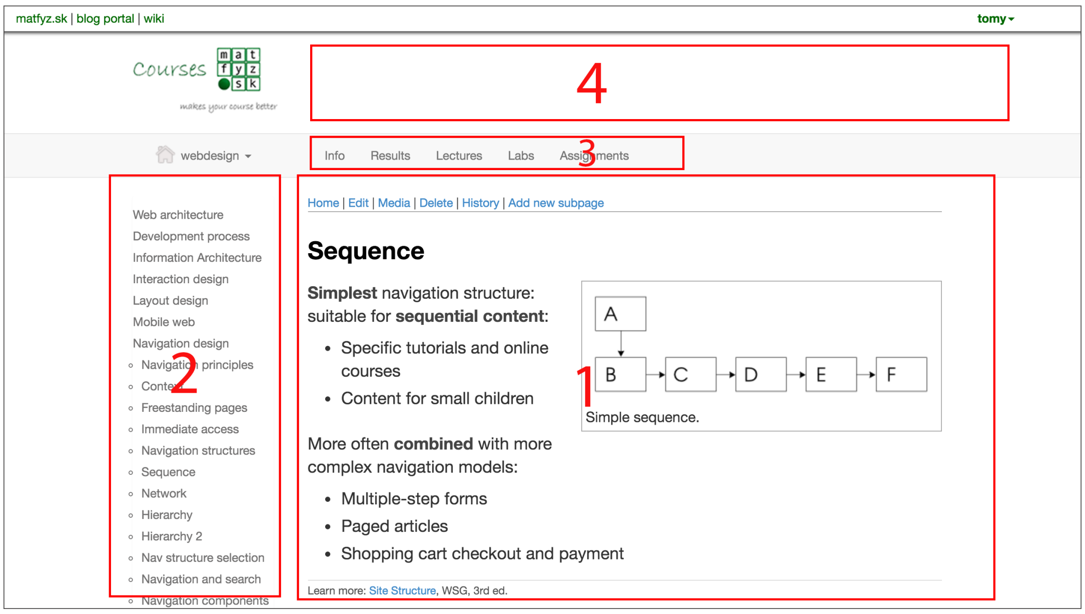
3.2.2 Modules

After system initialized all required classes, correct modules has to be run. Currently, there are 5 modules installed: `Core`, `Assignments`, `Quiz`, `Notes`, `Results`. Each module has different purpose and we will later explain `Assignments` throughoutly as it is main focus of this work. Other modules work similar and are not referenced by us, so we do not consider their description important for this work. It can, hovewer, be found in previous works [2].

3.2.3 Layout

Layout is managed by system part of this application. CodeIgniter default layout system is not sufficient for modularity, so it had to be replaced by a new one. Main problem was that each part of layout can be rendered by different module, which is decided at run-time. So page structure was divided into 4 different parts, each with its own rendering.

Courses 2 is build to offer one, root layout for all of the pages. It is not needed to create multiple different layouts in learning management system such as this. So there is just one, root layout, which is located in `application/views` directory of the project. This layout can be easily changed but this is not main focus of this work.



Sequence

Simplest navigation structure:
suitable for **sequential content**:

- Specific tutorials and online courses
- Content for small children

Simple sequence.

More often **combined** with more complex navigation models:

- Multiple-step forms
- Paged articles
- Shopping cart checkout and payment

Learn more: Site Structure, WSG, 3rd ed.

Figure 3.1: Courses 2 screenshot

As we can see on figure 3.1, root layout was split into 4 different parts, each with specific purpose and rendered independently. Each numbered part is rendered by selected module, the rest is rendered by system. This screenshot was rendered using `Notes` module as it is showing content of a lecture. Part number 4 is reserved for notifications, such as new assignment was created or so.

3.3 HMVC extension

Now, let's focus on hierarchical model-view-controller design pattern again. We indicated before this pattern plays the main role in implementation of Courses 2. It is done so that each module has it's own MVC flow which is then merged by System part. This approach si not directly supported by CodeIgniter, so changes had to be made.

To do so, in our predecessive work CodeIgniter Modular Extensions [12] was selected. This extension is licenced as open-source and can be freely used and distributed. One of the reasons for usage of this extensions was that in CodeIgniter we can't call more than 1 controller per request. Therefore, to achieve HMVC, we have to simulate controllers [12].

Modular extensions allow us to call subcontrollers in controllers, but these subcontrollers must extend `MX_Controller` class instead of `MI_Controller` class. Another difference is that all autoload files has to be specified in subcontroller and are no longer autoloaded by default. This differences are shown on listing 3.1.

Listing 3.1: Module controller

```php
<?php
class Module_controller extends MX_Controller
{
    $autoload = array(
        'helper'     => array('escape', 'form'),
        'libraries'  => array('email'),
    );
}
```

With this extension, all modules has are placed in `application/modules` directory and can be called by base CodeIgniter controller. To some degree, they can also communicate with each other, but it is not a good practice since modules aims to be separate.

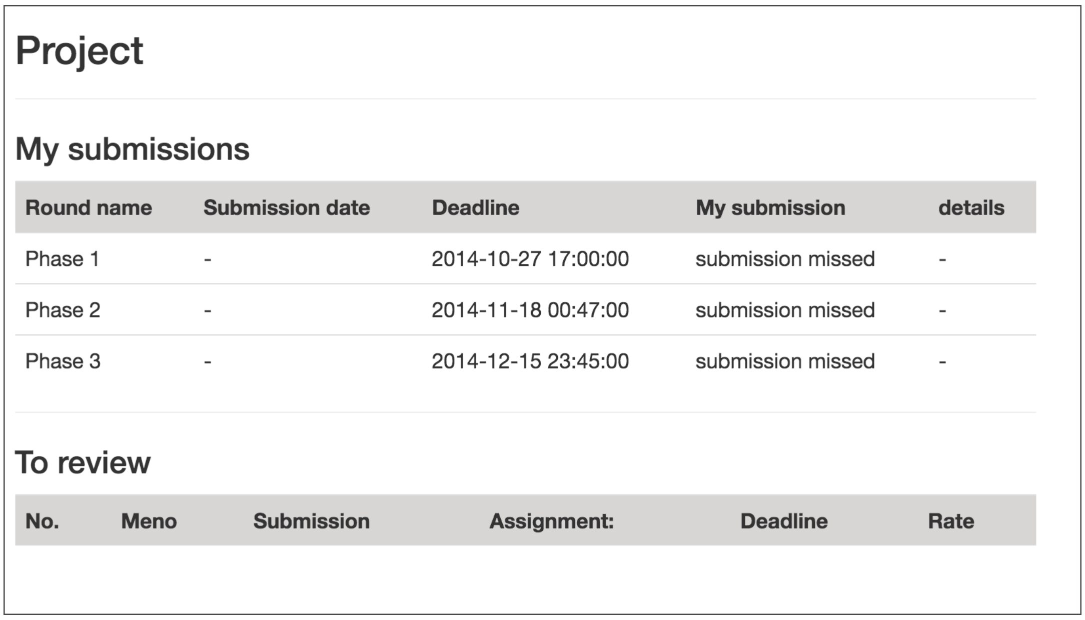
3.4 Assignments Module

Now, we will describe Assignments module, whose development aims to be core of this work. We will provide description as it was, before publishing this work and before any change to module was made. We consider this section to be important for diferentiating our work from what has been done.

Originaly, assignments module was developed for submitting blog posts with ability for users to review them. Hovewer this idea shifted to more complex module which provides multiple types of interfaces for managing student homeworks, file or URL submissions and student reviews. Now let's divide this module into student and teacher's part.

3.4.1 Student's part

Student's part does not offer a lot of functionality, it is designed to be as simple as possible. In fact, we considered this approach bad since a lot of students were confused about user interface and later had to redesign whole module in this work. As seen on figure 3.2, this interface is too minimalistic and student can often miss important deadlines.



Project

My submissions

Round name	Submission date	Deadline	My submission	details
Phase 1	-	2014-10-27 17:00:00	submission missed	-
Phase 2	-	2014-11-18 00:47:00	submission missed	-
Phase 3	-	2014-12-15 23:45:00	submission missed	-

To review

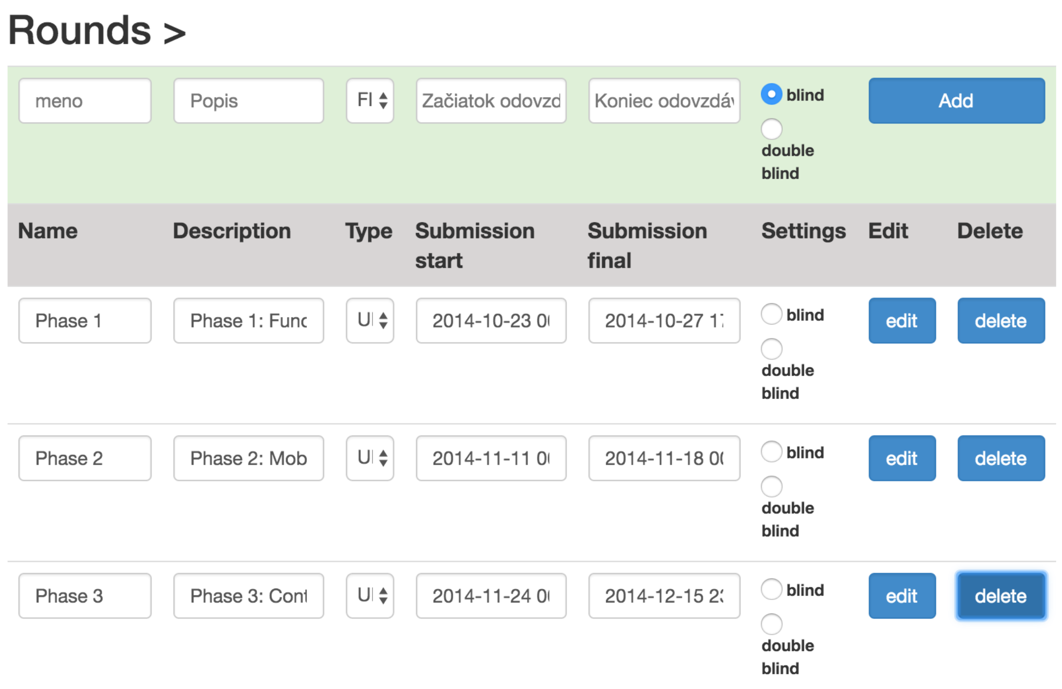
No.	Meno	Submission	Assignment:	Deadline	Rate

Figure 3.2: Student's part of assignment module

There are basicaly three possibilities: student can submit his homework assignment with added support for multiple assignment rounds. This means that each assignments can have multiple round, each of them can have different specifications. For example in first round, student must complete 50% of selected tasks and in second round all of the tasks have to be completed. Second important functionality is reviewing of each round. After student submits a submission, other students can see it and write their feedback to this student. These feedback are often also evaluated and projected into final grade of the course. Thirth possibility is to view evaluations from teacher and classmates.

3.4.2 Teacher's part

This interface is way more complex. It offers multiple screens, some of them are presented on figure 3.4 and 3.3. This interface also provides two important functionalities: assignment and review operations (create assignment, assign reviews on submitted assignments, delete assignment, edit assignment) and evaluation (assignments and reviews).



Rounds >

meno	Popis	Fl	Začiatok odovzd	Koniec odovzdáv	[✓ blind] double blind	Add

Name	Description	Type	Submission start	Submission final	Settings	Edit	Delete
Phase 1	Phase 1: Func	Ul	2014-10-23 0(	2014-10-27 1;	blind double blind	edit	delete
Phase 2	Phase 2: Mob	Ul	2014-11-11 0(	2014-11-18 0(	blind double blind	edit	delete
Phase 3	Phase 3: Cont	Ul	2014-11-24 0(	2014-12-15 2;	blind double blind	edit	delete

Figure 3.3: Teacher's administration of assignment rounds

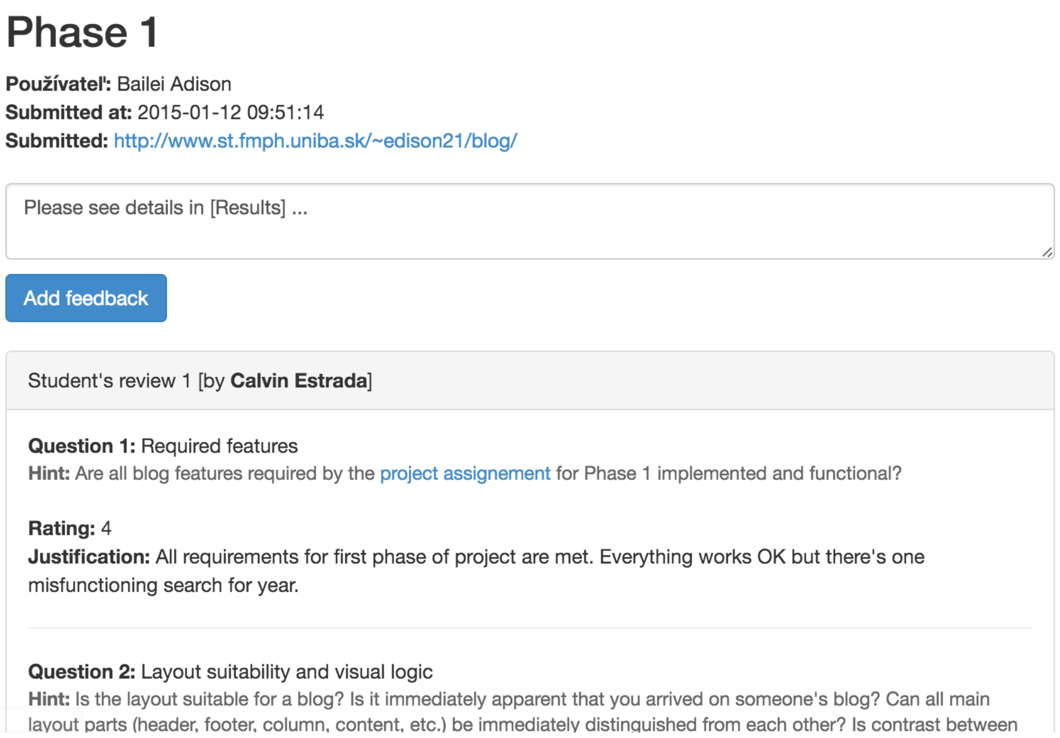
On figure 3.3 is shown assignment round management. It is possible to set name of the assignment (to diferentiate multiple assignments), set it's description (which may provide some instructions for students), type (URL of FILE), submission deadlines and blindness settings. This system also allows double blind assignments. It is also possible to set student review deadlines, questions and ratings.

On figure 3.4 we can see teacher's evaluation screen. Each round of an submitted assignment is presented on its own screen. The teacher is allowed to submit his own comment to this assignment and evaluate this assignment. There are also shown other student's reviews for this particular round of assignments.

3.5 Implementation

Whole module is located in `application/modules/assignment` folder with file structure as described by CodeIgniter Modular Extensions. Now let's go through code flow of this module.

At first, as soon as system part of Courses 2 finds out that assignment module has to be run, routing of this module takes part. All routes are located in


Phase 1

Používateľ: Bailei Adison
Submitted at: 2015-01-12 09:51:14
Submitted: http://www.st.fmph.uniba.sk/~edison21/blog/

Please see details in [Results] ...

Student's review 1 [by **Calvin Estrada**]

Question 1: Required features
Hint: Are all blog features required by the project assignement for Phase 1 implemented and functional?

Rating: 4
Justification: All requirements for first phase of project are met. Everything works OK but there's one misfunctioning search for year.

Question 2: Layout suitability and visual logic
Hint: Is the layout suitable for a blog? Is it immediately apparent that you arrived on someone's blog? Can all main layout parts (header, footer, column, content, etc.) be immediately distinguished from each other? Is contrast between

Figure 3.4: Teacher's evaluation of submitted assignments

`application/modules/assignment/routes.php`. This script also loads correct course from database and acts as a "bootloader". After correct controller is decided from routing, it is instantiated and run.

Listing 3.2: Routing in assignments module for administrator

```
if (is_admin())
{
    switch (url_segment(3))
    {
        case false:
            $route['assignments'] = 'user/assignments';
            break;
        case 'admin':
            $route['assignments'] = 'admin/assignments';
            break;
        case 'reviews':
            $route['assignments'] = 'admin/manage_reviews';
            break;
        default:
            $route['assignments'] = 'admin/manage_assignments';
    }

    return;
}
```

After end of Jakub Culik's [2] work, there were 6 controllers in this module. 3 of them were used for teacher's administration and 3 were used for student's part. All controllers extend `Module_Controller` class and implement `Module_Interface`, which is special superclasses for all modules controllers. Otherwise they comply with standard development habbits.

Models are located in `application/modules/assignment/models/` and views in `application/modules/assignment/views`. As seen on 3.3, since there is none template engine used, views easily get pretty complicated. There's a lot of programming and scripting languages mixed together which can bring great chaos. On listing 3.3 we can recognize HTML, PHP, PHP translations or even raw text mixed up together. We consider this a bad practice and propose usage of template engine system.

Listing 3.3: Example of view in assignments module

```
<h2><?= lang('rating') ?>: <?= $submission['round_name'] ?></h2>
<br>
<b><?= lang('for_submission') ?>:</b> <a href="<?=␣$submission['submission']␣?>"><?=
    $submission['submission'] ?></a><br>
<b>By:</b> <?= $submission['user_name'] ?><br><br>
```

3.6 Database Model

Database model is presented in appendices of this work.

Part II

Implementation

Chapter 4

Team projects

In this chapter, we are describing motivation, development, support and usage of team projects. This functionality was developped in summer of 2015 and then used and tested on Modern Approaches to Webdesign course during winter semester of 2016 at our faculty. Since then, multiple courses used team project functionality in Courses 2 Learning management system.

4.1 Motivation

4.2 Semantics

4.2.1 Team forming

4.2.2 Assignment submission

4.2.3 Peer review

4.2.4 Teamwork review

4.3 Implementation

odofjasdofij

Chapter 5

Assignments mirroring

TODO

Chapter 6

Other improvements

6.1 Peer review and improved submissions

In the educational context, peer reviews were shown to improve the engagement with the others work, they provide a different type of feedback from a different point of view than the instructor's one. Peer reviews foster discussion and experience exchange between the students, facilitating the social learning effect, a valued phenomenon according to the constructivist and constructionist learning theories. [9]

In this part of our work, we are describing implementation and flow of peer-review and improved submission support in Courses 2 learning management system. It is important to note, that support for peer reviews was already implemented in this system however it had to be refactored. Improved submissions were not present, however teacher could emulate them with creation of multiple assignments. Yet this approach was somehow confusing for students. One of the problems was, that there was a mess among submitted assignments and this problem needed to be fixed.

6.1.1 Peer-review workflow

The teacher creates the desired Assignment in the Assignments module. While creating an assignment the teacher can set its type (URL of FILE), deadlines, and allow improved submissions. The teacher may also enter questions for review phase if it is allowed. These will then be shown to other students.

The workflow of a single assignment round is depicted at 6.1. First two parts are mandatory, while the other three are configurable. In the next section, we are going to describe full workflow of the round.

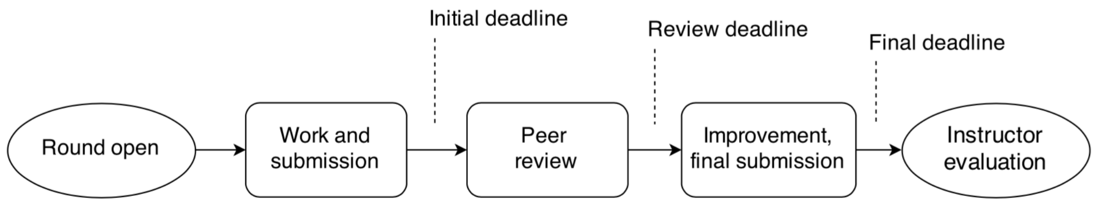


Figure 6.1: Peer review and improved submission flow

Once the round is open for submission by the course teacher, the students work on initial submission before the first deadline. Then, in second phase, the students who submitted their work are assigned three submissions to review (these submissions were submitted by their classmates and should be anonymouse - the reviewer does not know whose work is he assigned). These reviews should serve as feedback to their work and students should take them into account in the next phase. This is called improved submission, which is after all evaluated by the course teacher.

6.2 Connection of Assignment and Note module

One of the things, that students often complained was insufficient assignment description. In original Courses 2 assignments module there was just one simple textarea the teacher could enter description of any assignment. This problem needed to be solved.

First possible solution was to implement some assignments description submodule, but then again, we had already implemented Note module. It was easier and more usable to link output of this module to Assignments module.

6.2.1 Note module

Screenshot of Note module can be seen at figure 3.1. This module is providing two simple use cases.

For teacher, notes module is used to publish notes for lectures. Teacher can publish as many notes as he wants, each using HTML markup so it can include images, graphics, CSS styles and hyperlinks. These notes can also contain subnotes.

As opposed to teachers, students can only view these notes. As the reallity showed, these notes ofted contained important recommendations or explanations which could help students to improve their submissions. So why not link them together, right?

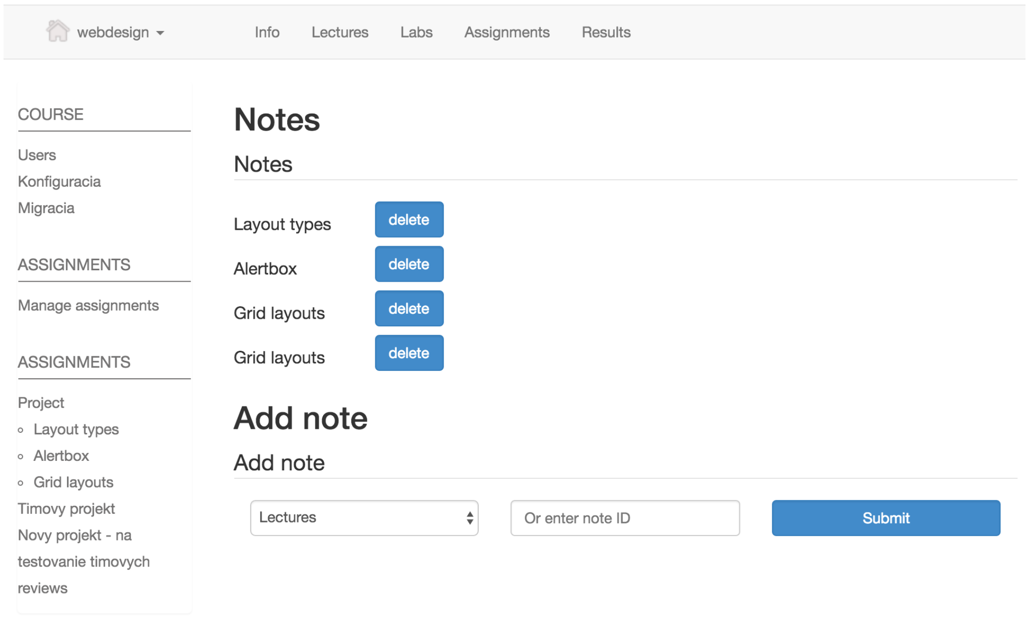


Figure 6.2: Adding notes to an assignment

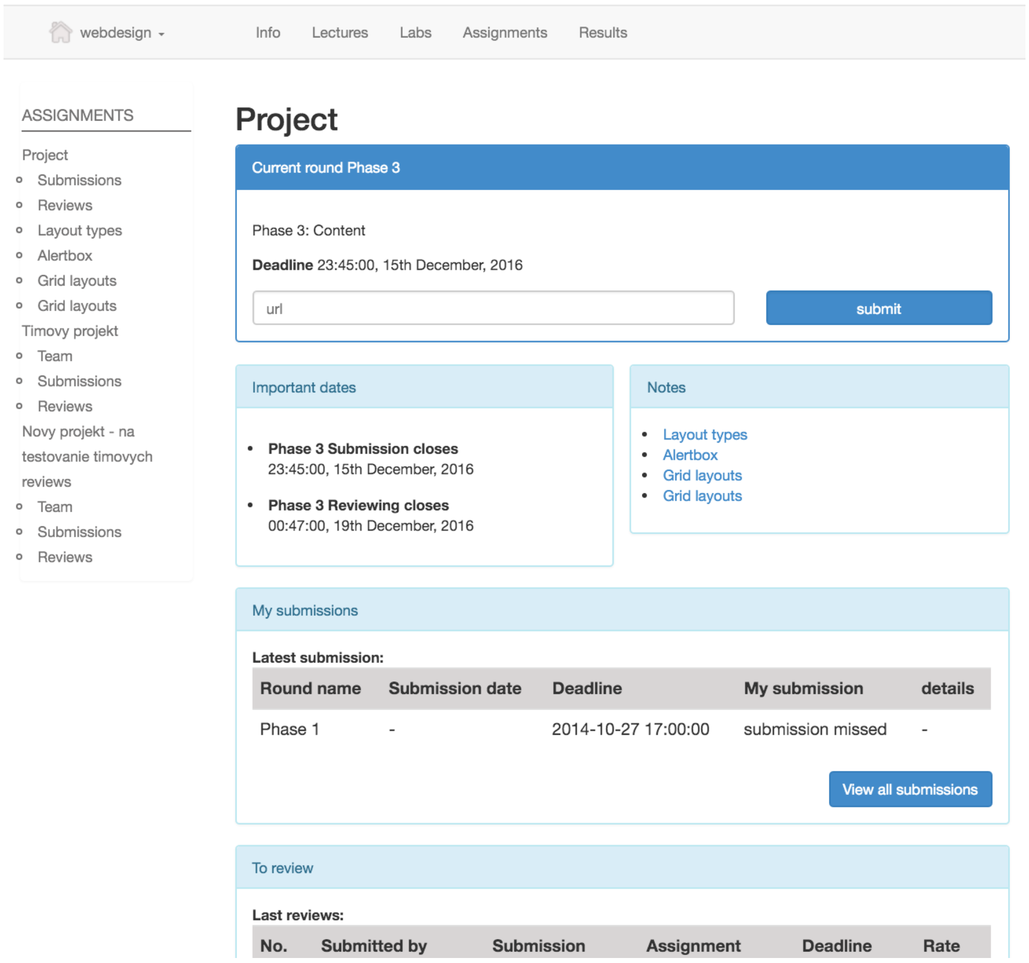
6.2.2 Implementation

As seen on figure 6.2, notes can be linked with an assignment and then can be shown together with it. This can be done only by a teacher in administration interface of an assignment. These notes are then showed in user dashboard. We explain this later, in the next section of these work.

For creating such connection, we altered database model and added a table `assignment_note`, which contains many to many relationship between fields `assignment_id` and `note_id`. When displaying any assignment, note module is providing an interface to get any note by it's id.

6.3 Assignment dashboard

After an intense development of Assignments module, interface for submitting and viewing submissions was ambiguous and primitive. With the ability to link notes from Notes module, things started to get scattered which could confuse students. After intense brainstorming about fixing this problem, we come up with an assignment dashboard. This dashboard could offer easy access to all notes, reviews and assignments and, what could be important, could notify students about upcoming deadlines.



Project

Current round Phase 3

Phase 3: Content

Deadline 23:45:00, 15th December, 2016

Important dates

- **Phase 3 Submission closes** 23:45:00, 15th December, 2016
- **Phase 3 Reviewing closes** 00:47:00, 19th December, 2016

Notes

- Layout types
- Alertbox
- Grid layouts
- Grid layouts

My submissions

Latest submission:

Round name	Submission date	Deadline	My submission	details
Phase 1	-	2014-10-27 17:00:00	submission missed	-

To review

Last reviews:

No.	Submitted by	Submission	Assignment	Deadline	Rate

Figure 6.3: Assignments dashboard

Result of our efforts is the dashboard that is shown on figure 6.3. This dashboard can be splitted into multiple sections.

First section is displaying current tasks student has to accomplish. This serves as a reminder on the top of the page and displays reviews to review or assignment rounds to submit if the user had not done it already

The next section displays important upcoming dates. There are shown 3 tasks with the closest deadline. These task may not be yet active and ready for submitting, we are just reminding students not to forget about them.

Section labelled as Notes is showing all notes of this assignment. These notes were explained in the previous section of this work.

Next section is called My submissions. This section shows only 3 latest submissions with ability to view all submissions. These submissions are then displayed on another page. This page is also part of dashboad.

Finally, section My reviews offers similar functionality as the previous section. All reviews can also be viewed on another page.

To sum up, all information any student needs to get information about his assignments can be viewes in this dashboard. The dashboard consist of subpages which aim to provide more information about student reviews and submissions.

6.4 Bug fixing and code maintenance

Finally, this work also included fixing many bugs found in previous versions of this system. Since Courses 2 was developed by multiple students, all separately developped parts sometimes didn't work well together so we had to find these bugs and fix them. We, however, do not consider these bugs to be important to write about.

End

TODO

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