

FACULTY OF ENGINEERING

REI 414
Practical:
E-Learning Platform

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1 Introduction

In this practical, an e-learning website is created to serve as a platform for communicating course material and evaluation results between lecturers and students. This documents is the report for this practical. It contains a description of the website's database, front-end and back-end structure.

2 Background

2.1 mySQL

2.2 Node.js

2.3 HTML

2.4 CSS

2.5 Javascript

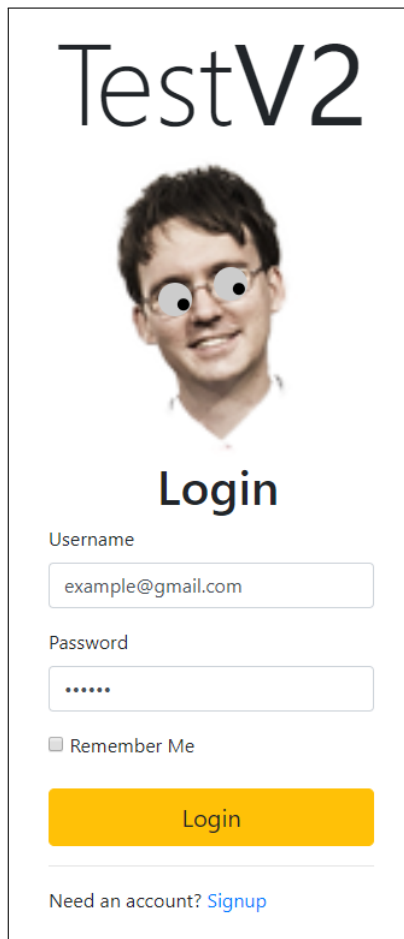
3 Database

4 Front-end


The following section provide images of the website's user interface to illustrate the front-end of the completed site.

4.1 Login and Register Interface

The first page any user encounters is the login page (figure [4.1](#)). If the current user does not have an account, the *Signup*-link can be used to browse to the registration page (figure [4.2](#)).



TestV2



Login

Username

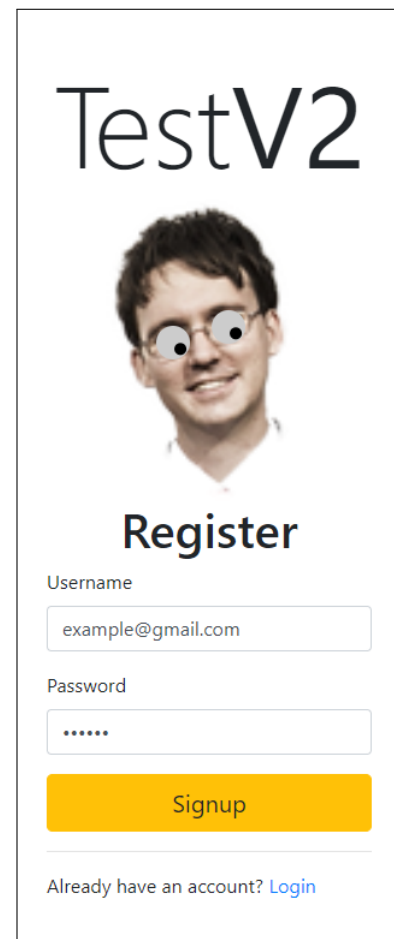
Password

☐ Remember Me


Login

Need an account? [Signup](#)

Figure 4.1: Login page



TestV2



Register

Username

Password

Signup

Already have an account? [Login](#)


Figure 4.2: Register page

4.2 Lecturer Interface

Upon signing in, lecturers are routed to the profile page where they can choose to create or add courses (figures 4.4 and 4.5). If the lecturer clicks on one of the added courses, he is taken to a corresponding section for managing the particular course.

Profile Create Course Add Course [Logout](#)

Lecturer Profile

 **Welcome Andreas**

My Courses: REII414 EERI222

Figure 4.3: Lecturer profile page

Create Course ×

Course Name

Course Description

Create

Close

Figure 4.4: Page for creating a course

Add Course ×

Available Courses:

EERI313 CEMI101 EERI414 EERI222 EERI333

REII414

Close

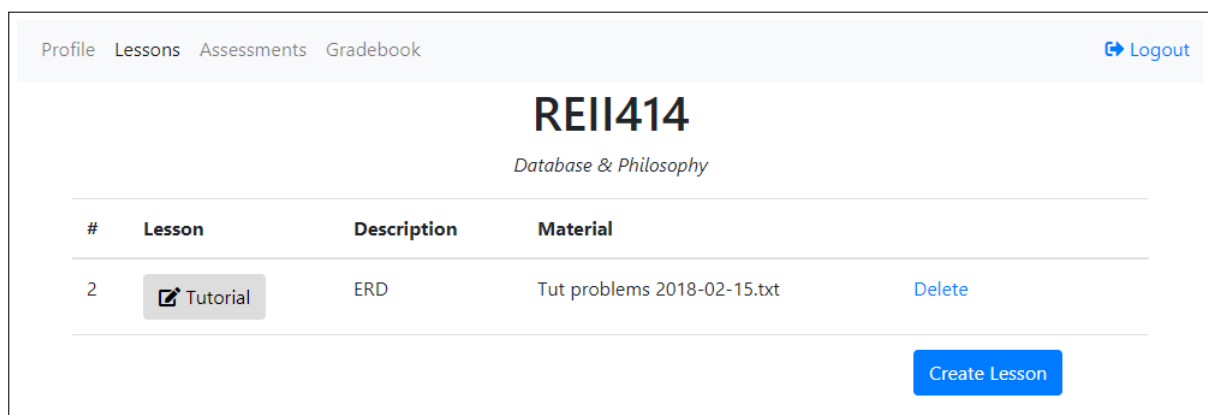
Figure 4.5: Page for adding a course

Figure 4.6 shows the page for creating and deleting lessons. The page shown in figure 4.7 is used to create new assessments (figure 4.9) and update student marks (figure 4.10). The page in figure 4.8 is used to view each student's marks for every assessment.

Profile Lessons Assessments Gradebook [Logout](#)

REII414

Database & Philosophy

#	Lesson	Description	Material
2	 Tutorial	ERD	Tut problems 2018-02-15.txt Delete

Create Lesson

Figure 4.6: Lecturer lessons page

Profile Lessons Assessments Gradebook [Logout](#)

REII414

Name	Description	Maximum Marks
Test 1	Super Easy	20

[Update Marks](#)

[Create Assessment](#)

Figure 4.7: Lecturer assessments page

Profile Lessons Assessments Gradebook [Logout](#)

REII414

Flashback to reality! There goes net neutrality! [×](#)

Student	Assessment Name	Mark
jpbeukes01@gmail.com	Test 1	3

Figure 4.8: Lecturer gradebook page

Create Assessment [×](#)

Name

Description

Maximum Mark

[Create](#)

[Close](#)

Figure 4.9: Creating assessments page

Update Student Marks

Student Name

Mark

[Create](#)

Figure 4.10: Update student marks page

4.3 Student Interface

Students have the same interface as lecturers, except for the editing functionality. No add, update or delete privileges are given to students, aside from the option of adding courses to their site. The profile page for students are given in figure 4.11, but all other examples of student pages are omitted in favour of brevity.

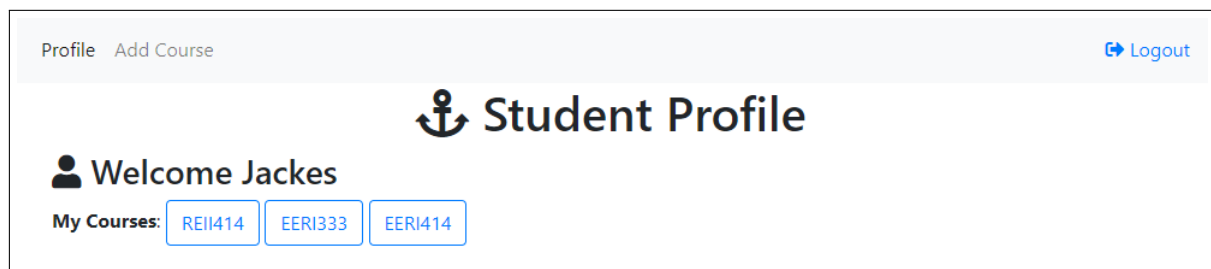


Figure 4.11: Student profile page

5 Back-end

5.1 Sign up and Login

The 'passport' package in Nodejs allows the site to handle sessions as well as cookies in an organised way. The session stores the current user's personal info inside his/her browser to allow for a personalised site.

The 'bcrypt' package allows the passwords to be encrypted in the database with the sha256 algorithm. This ensures that the system administrators can enter into the user's sites.

Figures 5.1 and 5.2 can be summarised as, insert new user into database with encrypted password. The user logging in gets flashed error messages; should the details entered be wrong.

```
// =====
// LOCAL SIGNUP =====
// =====
// we are using named strategies since we have one for login and one for signup
// by default, if there was no name, it would just be called 'local'

passport.use(
  'local-signup',
  new LocalStrategy({
    // by default, local strategy uses username and password, we will override with email
    usernameField : 'username',
    passwordField : 'password',
    passReqToCallback : true // allows us to pass back the entire request to the callback
  },
  function(req, username, password, done) {
    // find a user whose email is the same as the forms email
    // we are checking to see if the user trying to login already exists
    connection.query("SELECT * FROM users WHERE username = ?",[username], function(err, rows) {
      if (err)
        return done(err);
      if (rows.length) {
        return done(null, false, req.flash('signupMessage', 'That username is already taken.'));
      } else {
        // if there is no user with that username
        // create the user
        var newUserMysql = {
          username: username,
          password: bcrypt.hashSync(password, null, null) // use the generateHash function in our user model
        };

        var insertQuery = "INSERT INTO users ( username, password ) values (?,?)";

        connection.query(insertQuery,[newUserMysql.username, newUserMysql.password],function(err, rows) {
          newUserMysql.id = rows.insertId;

          return done(null, newUserMysql);
        });
      }
    });
  })
);
```

Figure 5.1: Code: Local Sign-up

```
// =====
// LOCAL LOGIN =====
// =====
// we are using named strategies since we have one for login and one for signup
// by default, if there was no name, it would just be called 'local'

passport.use(
  'local-login',
  new LocalStrategy({
    // by default, local strategy uses username and password, we will override with email
    usernameField : 'username',
    passwordField : 'password',
    passReqToCallback : true // allows us to pass back the entire request to the callback
  },
  function(req, username, password, done) { // callback with email and password from our form
    connection.query("SELECT * FROM users WHERE username = ?",[username], function(err, rows){
      if (err)
        return done(err);
      if (!rows.length) {
        return done(null, false, req.flash('loginMessage', 'No user found.')); // req.flash is the way to set flashdata using connect-flash
      }

      // if the user is found but the password is wrong
      if (!bcrypt.compareSync(password, rows[0].password))
        return done(null, false, req.flash('loginMessage', 'Oops! Wrong password.')); // create the loginMessage and save it to session as flashdata
      // all is well, return successful user
      return done(null, rows[0]);
    });
  })
);
```

Figure 5.2: Code: Local Login

5.2 Courses

Courses can be created and edited by lecturers, whereas students can only view the courses. Figure 5.3 shows how a new course is added to the database. Figure 5.4 shows how the course and all of its content is retrieved as a JSON object from the database and rendered to the user.

```
// =====
// Individual Courses =====
// =====
//open individual course and it's lessons for student
app.get('/course/:courseName', function(req,res){
  //select course and it's corresponding lessons
  let sql = 'SELECT * FROM lessons,courses WHERE lessons.COURSE_FK = courses.COURSE_ID and courses.courseName = ? order by lessonNumber asc';
  let query = connection.query(sql,[req.params.courseName], (err, results2) => {
    if(err) throw err;
    if(isEmpty(results2)) {
      if(req.user.lecturer > 0) {
        res.redirect('/profile');//moet course object paas maar is nie een
      } else {
        res.redirect('/profile');
      }
    } else {
      if(req.user.lecturer > 0){
        res.render('courseEdit.ejs',{user: req.user, course: results2});
      } else {
        res.render('courseView.ejs',{user: req.user, course: results2});
      }
    }
  });
});
```

Figure 5.3: Code: Create new course

```
//post add new course to db
app.post('/courses/new', function(req,res){
  // console.log(req.body);
  let sql = 'INSERT INTO courses (courseName, courseDescription, userID) VALUES (?,?,?)';
  let courseName = req.body.courseName;
  let courseDesc = req.body.courseDescription;
  let query = connection.query(sql,[courseName, courseDesc, req.user.id], (err, results) => {
    if(err) throw err;
    //add demo lesson
    let demo = 'demo';
    let sql = 'INSERT INTO lessons (COURSE_FK, lessonNumber, LESSON_NAME, LESSON_DESCRIPTION, LESSON_MATERIAL) VALUES (?,1,?,?,?) ';
    let query = connection.query(sql,[results.insertId, demo,demo,demo], (err, results) => {
      if(err) throw err;
      res.redirect('/profile');
    });
  });
});
```

Figure 5.4: Code: Get Courses

5.3 Lessons

The code in Figure 5.5 shows the post request when the lecturer creates a new lesson. The details of the lesson is added with the files and are sent to the server and database for later retrieval.

```
// =====
// Lessons =====
// =====
app.post('/course/:courseName/addlesson', function(req, res){
  //get course id
  var form = new formidable.IncomingForm();
  form.uploadDir = "/";
  form.parse(req, function (err, fields, files) {
    var oldpath = files.filetoupload.path;
    var newpath = createMaterialPath(req.params.courseName) + '/' + files.filetoupload.name;
    fs.rename(oldpath, newpath, function (err) {
      if (err) throw err;
      // res.write('File uploaded and moved!');
      // res.end();
    });

    var lessonNumber = fields.lessonNumber;
    var LESSON_NAME = fields.LESSON_NAME;
    var LESSON_DESCRIPTION = fields.LESSON_DESCRIPTION;
    var LESSON_MATERIAL = fields.LESSON_MATERIAL;
    let sql = 'SELECT COURSE_FK FROM lessons,courses WHERE lessons.COURSE_FK = courses.COURSE_ID and courses.courseName = ?';
    let query = connection.query(sql, [req.params.courseName], (err, results) => {
      if(err) throw err;
      console.log(results[0].COURSE_FK);
      var courseid = results[0].COURSE_FK;

      let sql = 'INSERT INTO lessons (COURSE_FK, lessonNumber, LESSON_NAME, LESSON_DESCRIPTION, LESSON_MATERIAL) VALUES (?,?,?,?,?) ';
      let query = connection.query(sql,[courseid, lessonNumber,LESSON_NAME,LESSON_DESCRIPTION,files.filetoupload.name], (err, results) => {
        if(err) throw err;
        res.redirect('/course/'+req.params.courseName);
      });
    });
  });
});
```

Figure 5.5: Code: Create Lessons

5.4 Assessments

The lecturer can add assessments to a course and enter the marks of the students for a specific assessment. Figure 5.6 below shows how a new assessment is posted to the database and how marks are inserted for a specific user.

```
app.get('/course/:courseName/assessment', function(req, res){
  let sql = 'SELECT * FROM assessments,courses WHERE assessments.COURSE_FK = courses.COURSE_ID and courses.courseName =?';
  let query = connection.query(sql, [req.params.courseName], (err, results) => {
    if(err) throw err;
    // console.log(results);
    if (req.user.lecturer > 0) {
      res.render('assessment.ejs', {availableAssessments: results, courseName:req.params.courseName}); //get assessments
    } else {
      res.render('assessment-student.ejs', {availableAssessments: results, courseName:req.params.courseName});
    }
  });
});

app.post('/course/:courseName/addAssessment', function(req, res){
  let sql = 'SELECT COURSE_ID FROM assessments,courses WHERE courses.courseName = ?';
  let query = connection.query(sql, [req.params.courseName], (err, results) => {
    if(err) throw err;
    // console.log(results[0].COURSE_FK);
    var courseid = results[0].COURSE_ID;

    let sql = 'INSERT INTO assessments (COURSE_FK, ASSESSMENT_NAME, ASSESSMENT_DESCRIPTION, ASSESSMENT_MAX_MARK) VALUES (?, ?, ?, ?)';
    var ASSESSMENT_NAME = req.body.ASSESSMENT_NAME;
    var ASSESSMENT_DESCRIPTION = req.body.ASSESSMENT_DESCRIPTION;
    var ASSESSMENT_MAX_MARK = req.body.ASSESSMENT_MAX_MARK;
    let query = connection.query(sql, [courseid, ASSESSMENT_NAME, ASSESSMENT_DESCRIPTION, ASSESSMENT_MAX_MARK], (err, results) => {
      if(err) throw err;
      console.log(results);
      res.redirect('/course/'+req.params.courseName);
    });
  });
});

//inserts marks for student on assessment
app.post('/course/:courseName/assessment/:ASSESSMENT_ID', function(req, res){
```

Figure 5.6: Code: Create and Update Marks for Assessments

5.5 Grade-book

Lastly the grade-book is split into two types, one for students and one for lecturers. The student grade book only gets the student's mark for all the assessments in that course. The lecturer's grade book show all the students and their respective mark for all of the assessments.

```
// =====
// =====Gradebook=====
// =====
//vir students view
app.get('/course/:courseName/gradebook', function(req, res){
  if(req.user.lecturer > 0){
    let sql = 'SELECT * FROM users,courses,assessments,marks WHERE assessments.COURSE_FK = courses.COURSE_ID and marks.ASSESSMENT_FK = assessments.ASSESSMENT_ID and marks.STUDENT_FK = users.id and courses.courseName = ? order by ASSESSMENT_NAME asc';
    let query = connection.query(sql, [req.params.courseName], (err, results) => {
      if(err) throw err;
      // console.log(results);
      req.flash('info', 'Flashback to reality! There goes net neutrality!');
      // res.json(results);
      res.render('gradebook.ejs', {message: req.flash('info'), marks: results, courseName:req.params.courseName}); //get marks for user
    });
  } else {
    let sql = 'SELECT * FROM marks,users,assessments,courses WHERE marks.STUDENT_FK=users.id and marks.ASSESSMENT_FK=assessments.ASSESSMENT_ID and assessments.COURSE_FK = courses.COURSE_ID and users.id = ? and courses.courseName =?';
    let query = connection.query(sql, [req.user.id, req.params.courseName], (err, results) => {
      if(err) throw err;
      // console.log(results);
      req.flash('info', 'Flashback to reality! There goes net neutrality!');
      // res.json(results);
      res.render('gradebook-student.ejs', {message: req.flash('info'), marks: results, courseName:req.params.courseName}); //get marks for user
    });
  }
});
```

Figure 5.7: Code: Grade book

6 Conclusion

6.1 Strengths

By using the Node js for developing instead of PHP creates a much more developer friendly environment. Using the Node js mysql library allows the developer to create queries that is already safe from SQL injections. Passwords are encrypted with sha256 inside the database. The structure of the database is easily expandable. All of the user's data is stored in a session and cookies, alleviating unnecessary requests to the server and making the website more personalised.

6.2 Flaws

An automatic assessment creator and marker would be better than manually typing in the marks students received for their tests. Manually typing in each student's mark for each assessment could become slow and tedious.

6.3 Improvements

Future versions of the website could include a section for online assessments, where lecturers are able to create new tests and students can complete existing tests. The website must then be able to evaluate the student's answers and update their marks.

The current version of the website can only be accessed via a local network. To launch the site for global use, a domain name have to be acquired.

A better developing scheme would be to use a MVC (Model View Controller) structure.

6.4 Techniques Learned

HTTP post and get requests where used extensively in this project. Hence, much knowledge of the protocol and its header structure where acquired.

How to set up a database and preform queries that have relationship with each other.

How to create a website with HTML, Javascript and CSS, whilst providing a user friendly experience to the users.