

**BILKENT UNIVERSITY  
ENGINEERING FACULTY  
DEPARTMENT OF COMPUTER ENGINEERING**

**CS 299  
SUMMER TRAINING  
REPORT**

**Boran YILDIRIM  
21401947**

**Performed at  
İNNOVA BİLİŞİM ÇÖZÜMLERİ**

**14.08.2017 - 14.09.2017**

Report template version: v1.0. October 02, 2017.

## Table of Contents

1. Introduction.....	3
2. Company Information .....	3
2.1. About the company .....	3
2.2. About your department .....	4
2.3. About the hardware and software systems .....	4
2.3.1. Java .....	4
2.3.2. Java Server Faces (JSF) .....	5
2.3.3. Apache Tomcat .....	5
2.4. About your supervisor .....	5
3. Work Done .....	6
4. Performance and Outcomes .....	9
4.1. Applying Knowledge and Skills Learned at Bilkent .....	9
4.2. Solving Engineering Problems .....	9
4.3. Team Work.....	9
4.4. Multi-Disciplinary Work .....	10
4.5. Professional and Ethical Issues .....	10
4.6. Impact of Engineering Solutions .....	10
4.7. Locating Sources and Self-Learning .....	11
4.8. Knowledge about Contemporary Issues .....	11
4.9. Using New Tools and Technologies .....	11
5. Conclusion.....	12
References.....	13
Appendices .....	14

## **1. Introduction**

I have done my training in Innova IT Solutions Inc. The main motivation for me to choose Innova for an internship was the huge size of the company by means of hiring above one thousand employees and significant achievements of the company. I wanted to observe how works are executed in a big company and how people interact with each other.

I have developed a captcha control system for authentication pages which protects the system from robot logins. The company did not allow me to contribute to their codebase due to security and privacy reasons. Thus, I have developed this project as a separated library which can be integrated to all projects of the company.

In this report, first, I will reflect general information about the company and mainly the department I have trained. Then, I will explain the software systems I used throughout my project. I will clarify the specific work I have done and tell more about the significance of the work. Finally, the performance outcomes will be described under multiple topics.

## **2. Company Information**

### **2.1. About the company**

Innova is Turkey's leading IT solutions company with its professional staff of over 1000 people with different technologies. Since 1999, Innova has been providing platform-independent solutions to organisations in every sector, especially telecommunication, finance, production, public and service

sectors, and has succeeded in exporting solutions produced in international standards to 37 countries up to 4 continents.

In 2007, Turk Telekom bought Innova. Istanbul and Ankara are main offices, as well as 12 offices spread over various parts of Turkey activities continue. [1]

## **2.2. About your department**

I was hired in a department called Telco OSS/BSS, OSS stands for Operational Support Systems and BSS stands for Business Support Systems. It was the biggest department in the company with over 300 employees. I was part of a small group in that department with 1 supervisor and 3 software engineers. That group was work on a project for customisation of a software for Turk Telekom which was purchased from SAP. The department works for telecom operator companies. [2]

## **2.3. About the hardware and software systems**

### **2.3.1. Java**

Java is a general-purpose computer programming language that is concurrent, class-based, object-oriented. It is intended to let application developers "write once, run anywhere" (WORA), meaning that compiled Java code can run on all platforms that support Java without the need for recompilation. Java applications are typically compiled to bytecode that can run on any Java Virtual Machine (JVM) regardless of computer architecture and operating system. [3]

### **2.3.2. Java Server Faces (JSF)**

It is a server side component based user interface framework. It is used to develop web applications. It provides a well-defined programming model and consists of rich API and tag libraries.

The JSF API provides components (inputText, commandButton etc) and helps to manage their states. It also provides server-side validation, data conversion, defining page navigation, provides extensibility etc. [4]

### **2.3.3. Apache Tomcat**

Tomcat is an application server from the Apache Software Foundation that executes Java servlets and renders Web pages. [5]

## **2.4. About your supervisor**

Name: Serkan Doğdu

Job Title: Program Manager

University: Hacettepe University

Department: Computer Science and Engineering

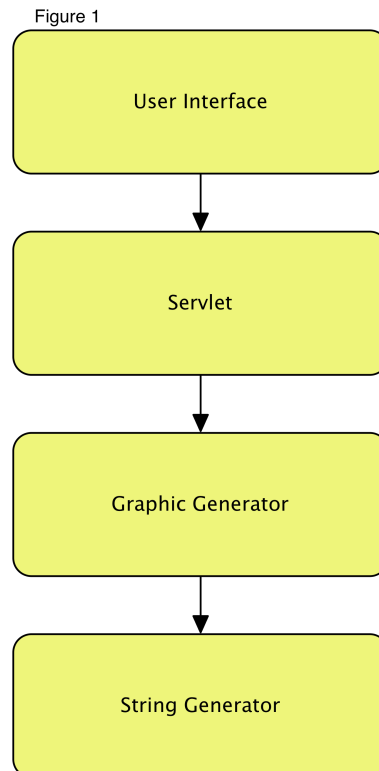
Year of Graduation: 1997

### 3. Work Done

I have developed a captcha control system for disabling robot logins to the system developed by the software engineers of the company.

Object Oriented Programming approach was used as deeply as possible. 4

Layer architecture was used for developing that project.



The String Generator is generating a random String for displaying on graphic. I trust to the power of randomness. Thus, a character is selected randomly. Also whether a character will be a number or a letter also selected randomly. The code below shows how this process is done in a function.

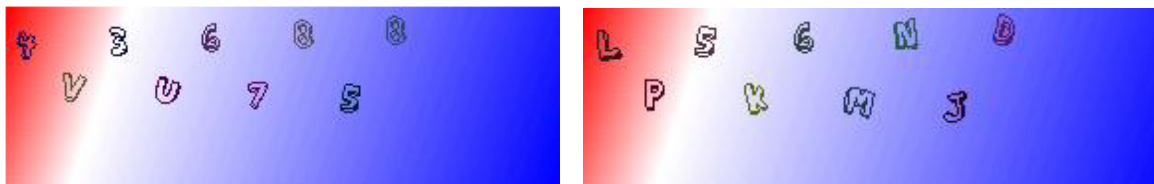
```

private String generateCaptchaString(int numberOfChars) {
    Random rand = new Random();
    StringBuilder result = new StringBuilder();
    final int numBase = 49; // 0 not included (1)
    final int numCeil = 57; // 9
    final int charBase = 65; // A
    final int charCeil = 90; // Z

    for (int i = 0; i < numberOfChars; i++) {
        // selection for number or letter
        switch (rand.nextInt( bound: 2)) {
            case 0:
                char randChar = (char) (rand.nextInt( bound: charCeil - charBase) + charBase);
                result.append(randChar);
                break;
            case 1:
                char randNum = (char) (rand.nextInt( bound: numCeil - numBase) + numBase);
                result.append(randNum);
                break;
        }
    }
    return result.toString();
}

```

The Graphic Generator makes a function call to String Generator to generate a random String to show in its graphic content. For drawing the graphic also randomness was used for putting characters. Although all of the characters are in the same order as the returned value of String Generator, every load of the page the characters tilted by changing y and x coordinates in a way that will not prevent the user from understanding it. Two examples of the generated graphics are below.



As you can see that in the same position characters are tilted different ways.

Servlet is mainly responsible for handling the network I/O operations. The graphic which is generated by Graphic component is received by Servlet and when the client request for the web page, the servlet upload the captcha image to the UI. The String of the image is also brought to the Servlet to compare its value with the user entered text. Two examples of the UI are on the next page.

Name:

Password:




I am not a robot

After Re-captcha pressed the graphic is changed and it is expected that user will enter the value of new one.

Name:

Password:



I am not a robot



## **4. Performance and Outcomes**

### **4.1. Applying Knowledge and Skills Learned at Bilkent**

Besides all the information I gathered from my education in Bilkent, I mainly convert my theoretical knowledge on CS101 and CS102 classes to practice, in which I learned Java Programming Language. Java is the main language I used throughout the internship project. CS 319 helped me to learn Object Oriented Programming and team work deeply, I have used both of them through the internship. Further, as Bilkent has an interactive social environment, I realised that as an engineering student, I have great communication skills comparing to other school graduates.

### **4.2. Solving Engineering Problems**

Software Engineering requires serious researching, analysis, system design, object design, implementation and testing. I began with working on which features that I need for starting on my project and determined my necessary tools which are Java Server Faces and Tomcat. Then, I read about these topics from Internet. Some mistakes that are so tiny but important wasted my time but it helped me how to act and plan against my simple but enlightening project.

### **4.3. Team Work**

Team work is an indispensable concept of the developing software world. As the projects on computer science get complicated and huge day by day, to handle a project without having a team is almost impossible or too difficult. Thus, realising the importance of team work and being in corporation with team mates are vital. My internship in Innova offered me a great

experience to realise the importance of team work, that is to say my supervisor and engineers on the project I work for and I became a harmonious team.

#### **4.4. Multi-Disciplinary Work**

In the project which my team works on, database are developed by this team. Frontend and backend were done by SAP and the team customises the code developed by SAP. The other teams rather than software application development which are security, information security and so on are also connected to each other and they share knowledge and skills.

#### **4.5. Professional and Ethical Issues**

Innova is a well known IT solutions provider in Turkey so that the company provide solutions to numerous different sectors. The team members that are in Telco section work with each other in full respect. Additionally, Innova shares a building with other Turk Telekom companies, Sebit and Argela . The members of the building share ideas without any misbehaviour and insult or humiliation during lunch breaks. In the Innova, every member shares his thought and ideas without hesitation.

#### **4.6. Impact of Engineering Solutions**

My project has been decided to integrate to projects are developed by the company. They even asked me to join them after the end of my Bachelor's Degree. What is more, Java is a mainly used enterprise software in the projects so using it as an expert is significant in the sector. The demonstration I made also has positive impact on my colleagues.

#### **4.7. Locating Sources and Self-Learning**

I learnt new tools to practice Java and get familiar to JSF and Tomcat. I can now quickly understand the structure of a JSF Code and organise it for my own purpose. Additionally, I can now use my experience on CS 491/492 or GE 401/402 Senior Project.

#### **4.8. Knowledge about Contemporary Issues**

JSF is losing popularity among backend developers. Rather than JSF, Spring MVC is gaining popularity on Java backend developing. Hence applying a practice of JSF gave me a good knowledge about a contemporary issue. There are also lots of free captcha library which are more useful and secure than my project, such as Google reCaptcha and JCapcha (Java). Thus, in my opinion the project I worked on does not handle contemporary technologies.

#### **4.9. Using New Tools and Technologies**

I have never used Java Server Faces and Apache Tomcat before. I learned how to use them properly and efficiently.

## **5. Conclusion**

At the end of my summer internship, according to my team members, I am now a part of the company. The flow of events seemed to be so quick but they had a deep impact on me. I first learnt how to identify a problem. After watching lots of tutorials and reading documentations, I figured out which software tools and environment to use. Therefore, I studied JSF on my own from the very beginning. The result was a total success. I satisfied my supervisor and team members. They told me that they realised Bilkent has a different quality to educate students and prepare them to real world problems and business. If I had not studied and passed the courses that I took in Bilkent with good grades, I would not have impressed the Innova Team this much. To sum up, this summer training opened my eyes to the real world, I have a vision about the big issues, what people think and how they behave towards situations. I saw the big pictures behind the companies and I am beginning to understand their methods to stay alive in the business. It warned me to determine my goals and start acting without wasting any time.

## References

[1] "About the Company". <http://www.innova.com.tr/innova-hakkinda.asp>

[Accessed: Sept 25, 2017].

[2] "About the department". [http://www.innova.com.tr/innova-ekibi-](http://www.innova.com.tr/innova-ekibi-calisanlar.asp)

[calisanlar.asp](http://www.innova.com.tr/innova-ekibi-calisanlar.asp) [Accessed: Sept 25, 2017].

[3] "Java". <https://www.java.com/tr/about/>

[Accessed: Sept 26, 2017].

[4] "Java Server Faces". [http://www.oracle.com/technetwork/java/javaee/](http://www.oracle.com/technetwork/java/javaee/javaserverfaces-139869.html)

[javaserverfaces-139869.html](http://www.oracle.com/technetwork/java/javaee/javaserverfaces-139869.html) [Accessed: Sept 26, 2017].

[5] "Apache Tomcat". <http://tomcat.apache.org>

[Accessed: Sept 26, 2017].

## Appendices

```
import javax.faces.bean.ManagedBean;
import java.util.Random;

@ManagedBean(name = "captchaControl", eager = true)
public class CaptchaControl {

    private String currentCaptcha;

    CaptchaControl() {
        currentCaptcha = null;
    }

    private String generateCaptchaString(int
numberOfChars) {
        Random rand = new Random();
        StringBuilder result = new StringBuilder();
        final int numBase = 49; // 0 not included (1)
        final int numCeil = 57; // 9
        final int charBase = 65;    // A
        final int charCeil = 90;    // Z

        for (int i = 0; i < numberOfChars; i++) {
            // selection for number or letter
            switch (rand.nextInt(2)) {
                case 0:
                    char randChar = (char)
(rand.nextInt(charCeil - charBase) + charBase);
                    result.append(randChar);
                    break;
                case 1:
```

```

        char randNum = (char)
(rand.nextInt(numCeil - numBase) + numBase);
        result.append(randNum);
        break;
    }
}
return result.toString();
}

String generateCaptchaString() {
    currentCaptcha = generateCaptchaString(8);
    currentCaptcha = generateCaptchaString(9);
    return currentCaptcha;
}

String getCaptchaText() {
    return currentCaptcha;
}
}

```

```

import javax.faces.bean.ManagedBean;
import java.awt.*;
import java.awt.geom.Point2D;
import java.awt.image.BufferedImage;
import java.util.Random;

@ManagedBean(name = "captchaGraphics", eager = true)
public class CaptchaGraphics {

    private CaptchaControl control;

    CaptchaGraphics() {
        control = new CaptchaControl();
    }

    BufferedImage getCaptchaImage() {
        String message = control.generateCaptchaString();
        int width = 300;
        int height = 100;
        BufferedImage img = new BufferedImage(width,
height, BufferedImage.TYPE_USHORT_565_RGB);

        // random will be used for selection of color
        Random randColor = new Random();

        Graphics2D graphics = img.createGraphics();
        //graphics.setColor(Color.black);
        graphics.setFont(new Font("Action Jackson",
Font.PLAIN, 20));

        FontMetrics fontMetrics =
graphics.getFontMetrics();

```



```

        int stringWidth =
fontMetrics.stringWidth(message);
        int stringHeight = fontMetrics.getAscent();

        Point2D start = new Point2D.Float(0, 0);
        Point2D end = new Point2D.Float(300, 100);
        float[] dist = {0.0f, 0.2f, 1.0f};
        Color[] colors = {Color.RED, Color.WHITE,
Color.BLUE};
        LinearGradientPaint p =
            new LinearGradientPaint(start, end, dist,
colors);
        graphics.setPaint(p);
        graphics.fill(new Rectangle(300, 100));

        int rand = randColor.nextInt(10);

        for (int i = 0; i < message.length(); i++) {
            graphics.setColor(new
Color(randColor.nextInt(100), randColor.nextInt(100),
randColor.nextInt(100)));
            if (i % 2 == 0) {

graphics.drawString(String.valueOf(message.charAt(i)), 25
* i + rand, 35 - i - rand);
            }
            else {

graphics.drawString(String.valueOf(message.charAt(i)), 25
* i + rand, 45 + i + rand);
            }
        }
        graphics.dispose();

```

```
        return img;
    }

    String getCaptchaText() {
        return control.getCaptchaText();
    }
}
```

```

import javax.imageio.ImageIO;
import javax.servlet.ServletException;
import javax.servlet.http.HttpServlet;
import javax.servlet.http.HttpServletRequest;
import javax.servlet.http.HttpServletResponse;
import java.io.IOException;
import java.io.OutputStream;

public class CaptchaServlet extends HttpServlet {

    private CaptchaGraphics graphics = new
CaptchaGraphics();

    private void captchaImageRequest(HttpServletRequest
request,

HttpServletResponse response) throws IOException {
        response.setContentType("image/jpg");

        OutputStream outImage =
response.getOutputStream();
        ImageIO.write(graphics.getCaptchaImage(), "jpg",
outImage);
        outImage.close();
    }

    private void submitCaptchaRequest(String captchaText)
{
        if
(captchaText.equals(graphics.getCaptchaText())) {
            // TODO go to home page after login

```

```

        System.out.println("Yes");
    }
    else {
        // TODO captcha entry is wrong
        System.out.println("noo");
    }
}

protected void doGet(HttpServletRequest request,
                      HttpServletResponse response)
throws ServletException, IOException {

    String username =
request.getParameter("username");
    String password =
request.getParameter("password");
    String captchaText =
request.getParameter("captchaText");

    // TODO the condition will be controlled with
database.

    if (username == null && password == null) {
        captchaImageRequest(request, response);
    }
    else {
        assert username != null;
        if ((!username.equals("")) && !
password.equals(""))) {
            submitCaptchaRequest(captchaText);
        }
        else {

```

```
        captchaImageRequest(request, response);
    }
}
}
```

## Self-Checklist for Your Report

*Please check the items here before submitting your report. This signed checklist should be the final page of your report.*

- ☐ Did you provide detailed information about the work you did?
- ☐ Is supervisor information included?
- ☐ Did you use the Report Template to prepare your report, so that it has a cover page, the 8 major sections and 13 subsections specified in the Table of Contents, and uses the required section names?
- ☐ Did you follow the style guidelines?
- ☐ Does your report look professionally written?
- ☐ Does your report include all necessary References, and proper citations to them in the body?
- ☐ Did you remove all explanations from the Report Template, which are marked with yellow color? Did you modify all text marked with green according to your case?

Signature: \_\_\_\_\_