HACETTEPE UNIVERSITY
ENGINEERING FACULTY
DEPARTMENT OF COMPUTER ENGINEERING

BBM 425
INTERNSHIP REPORT

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Performed at
TÜBİTAK BİLGEM Yazılım Teknolojileri Araştırma Enstitüsü (YTE)

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1 Introduction

I worked as a software engineer intern at Tübitak YTE . Tübitak YTE develops R&D-focused software solutions that take into account new technologies and innovative approaches to meet the digital transformation needs that provide digital policies of public institutions and organizations. I chose to work here because I wanted to see how it would be like to work in a bigger corporate since I did my first internship at a smaller one. Also Tübitak YTE is the one and only institution owning **CMMI**[1] Level 5 accreditation located in Turkey and it is a member of The **Open Group**[2] consortium.

My internship can be summarized in 2 different phases. First one is seminars phase and second one is project phase. In the first phase I with other interns attended to a bunch of different educational seminars. The reason of the seminars is to make interns ready for the project phase. In the second phase I started to coding. The job I was assigned was at first was an alert system where we were supposed to meet and develop back-end, front-end, database management systems and Java. My second assignment was to create an object detection application in Python.

2 Company Information

2.1 About the company

Tübitak YTE is located in Çukurambar/Ankara. In 2005, the G222 Project Unit, which started to work under the affiliation of TÜBİTAK Department of National Research Institute of Electronics and Cryptology Design and Development Engineering (UEKAE), has been structured as Software and Data Engineering Department in 2010. In 2012, it has been transformed into an institute under the name of Software Technologies Research Institute (YTE) affiliated with Informatics and Information Security Research Center (TÜBİTAK-BİLGEM). Organizational chart of the Tübitak YTE can be seen in figure 1.

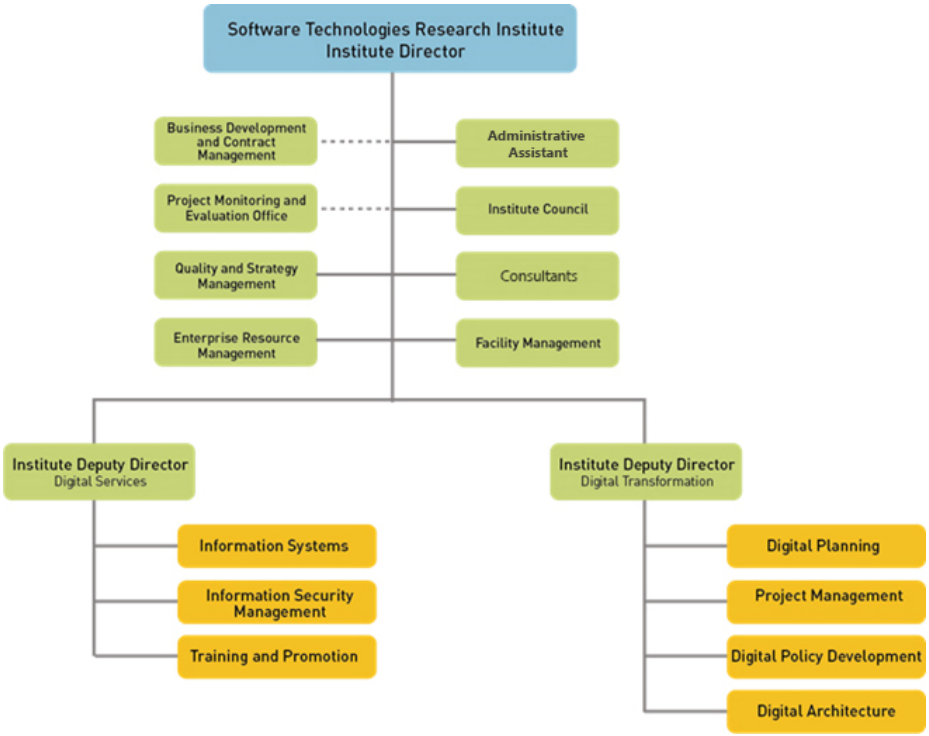

Figure 1: Organizational Chart of Tübitak YTE

2.1.1 Business Areas and Keywords

Tübitak YTE is a non-profit corporate. So their goal is not just to create end products. They also prepare references, digital government strategies, digital development strategies and web applications. All business areas of the Tübitak YTE can be summarized as:

- Define national, institutional and plan solutions wtih innovative approaches thematic digital transformation needs with an enterprise architecture perspective and innovative guidelines.
- Conduct strategic, critical and R&D software development projects in digital government policies.
- Develop guideline and reference models with the purpose of building capacities required in informatics ecosystem and to provide guidance.
- Build capacity in new technology areas by following international digital trends and developments.
- Conduct policy researchers to improve the performance and quality of informatics ecosystem.

2.1.2 Products

2.2 About the department

I listed some of the products of Tübitak YTE below:

- IT SYSTEM OF ENERGY MARKET REGULATORY
- DATA CENTER MODERNIZATION
- PRE- ANALYSIS of BTK INFORMATION MANAGEMENT SYSTEM
- PUBLIC INTERNET SITES GUIDE
- e-TRANSFORMATION ANALYSIS and TECHNICAL SUPPORT and CONSULTING SERVICE
- FUNCTIONAL EVALUATION of ERP System

And lot more. Most of these projects and products are made for public establishments.

2.3 About the hardware and software systems

Main business area is of the Tübitak YTE is software and web application development. Therefore hardware or GPU specification was not needed. But Tübitak YTE provides each and every employee with company computers.
Software range on the other hand is pretty wide. There are open-source software but of the software used there is licensed. Mostly used open-source software is **Postgresql**[3], a relational database.

For front-end Tübitak YTE uses React[4].

2.4 About the supervisor

Name & Surname	Fatih Buğra Çetinkaya
Address	Çukurambar Mah. Malcolm X Caddesi No:22 06100 Çankaya/ANKARA
Phone Number	+90 (312) 289 92 22
Email Address	fbugra@gmail.com
Education	Atılım University/Computer Science,2007

3 Work Done

I summarized my work in two sections. First one is the seminars and educational phase. Second one is projects phase.

3.1 Seminars

In this part I attended to a lot of courses related to software engineering, programming techniques and some of the technologies we are going to use.

First course was about agile software development techniques and scrum. Agile development uses short cycles, iterative development, collaboration and interaction. As an opposite to the waterfall development. Agile software development and principles of it are shared on 'Manifesto for Agile Software Development'[5].

Scrum[6] on the other hand, is a framework created to solve complex problems and adapt to new building processes of products.

Another important course was about **Spring Framework**. Spring is powerful tool that was built on Java. It helps with configuration and development of projects. I also attended to postgresql course and learnt to work with both postgresql and Spring Boot. Postgresql is a poweful open source relational database. It is well documented. These reasons make it useful for many companies including Tübitak YTE .

Another important course was about Node.js. Node.js is an asynchronous and event-driven runtime library for Javascript. It is widely use because of its component system and scalability. Here's a code snippet to run 'Hello World' with node.js:

```
const http = require('http');

const hostname = '127.0.0.1';
const port = 3000;

const server = http.createServer((req, res) => {
  res.statusCode = 200;
  res.setHeader('Content-Type', 'text/plain');
  res.end('Hello World\n');
});

server.listen(port, hostname, () => {
  console.log(`Server running at http://${hostname}:${port}/`);
});
```

And here's a snippet to create a database with postgresql.

```
CREATE DATABASE hrdb
 WITH ENCODING='UTF8'
 OWNER=hr
 CONNECTION LIMIT=25;
```

I used DBeaver[7] to debug database.

Here you can see A fiddle component progress bar created with React.

```
import React, { Component } from 'react';
import FiddleComponent from "./FiddleComponent";
import progress from 'react-bootstrap/ProgressBar';


const scope = {progress};
class Addon17 extends Component {
    render() {
        return (

            <div>
                <FiddleComponent code='<div className="progress">
  <div className="progress-bar w-75" role="progressbar" aria-valuenow="75" aria-
    valuemin="0" aria-valuemax="100"></div>
</div>' scope={scope} ></FiddleComponent>

                <FiddleComponent code='<div className="progress">
  <div className="progress-bar bg-warning w-25" role="progressbar" aria-valuenow="75"
    aria-valuemin="0" aria-valuemax="100"></div>
</div>' scope={scope} ></FiddleComponent>

                <FiddleComponent code='<div>Furkan Caglayan</div>'></FiddleComponent>


            </div>
        );
    }
}

export default Addon17;
```

Other courses include Object Oriented Programming course, health in workplace course and cyber security course.

3.2 Projects

3.2.1 Alert App

My first project was to create an alert system. Alert system is basic web application that I did to learn more about database management, React, JavaScript and Spring. Project had 4 main parts: Postgresql for Database, Node.js for backend, React for frontend and Spring/Java for merging and other parts.

Alert system would have following properties:

1. Can create requests
2. Each request will be saved to database
3. Requests will have a time parameter.
4. Requests will repeat itself asynchronously
5. Request status will be seen as a plot graph
6. Requests can be deleted.
7. Request will be shown as a table

First I started with coding front end. I added a gradient background and simple layouts. Then I proceeded to do the back end part with axios library. I configured Java with postgresql using Spring Framework. I added a code sample on how to do that.

```
## default connection pool
spring.datasource.hikari.connectionTimeout=20000
spring.datasource.hikari.maximumPoolSize=5

## PostgreSQL
spring.datasource.url=jdbc:postgresql://localhost:5432/postgres
spring.datasource.username=postgres
spring.datasource.password=password

#drop n create table again, good for testing, comment this in production
spring.jpa.hibernate.ddl-auto=create

```

After coupling database with Spring, now I had to do Spring commands for database management. I used hibernate and persistence for that.

3.2.2 Object Detection

For my second project, I implemented an object detection program with PyTorch[8]. I used embedded Res-Net50 object detection model. I took the input from webcam using opencv video capture module. I used the code snippet below.

```
import numpy as np
import cv2

cap = cv2.VideoCapture(0)

while(True):
    # Capture frame-by-frame
    ret, frame = cap.read()
    #get bounding boxes and labels
    #draw boxes on the frame
    # Display the resulting frame
    cv2.imshow('frame',gray)
    if cv2.waitKey(1) & 0xFF == ord('q'):
        break

# When everything done, release the capture
cap.release()
cv2.destroyAllWindows()
```

4 Performance and Outcomes

4.1 Applying Knowledge and Skills Learned at Hacettepe

Tübitak YTE applies software engineering techniques, strategies and design patterns. Software Engineering class in Hacettepe helped me a lot trying to apply these techniques and patterns. For example I was supposed to implement MVC(model-view-controller) design pattern in the first project(alert system), because I had already seen it in Software Engineering(BBM 382) I could easily implement it. Also, general knowledge I had acquired from lab courses and assignments helped me a lot.

4.2 Solving Engineering Problems

As I said in 'Applying Knowledge and Skills Learned at Hacettepe', Tübitak YTE uses software engineering techniques everywhere. So I also applied these techniques including design patterns and engineering methods.

4.3 Teamwork

In the seminars phase, we implemented basic back-end functionalities as team but overall projects were solo projects. Also, interns are always in contact with their advisors for any programming related problem as me.

4.4 Multi-Disciplinary Work

Tübitak YTE has to apply multi-disciplinary work in their every project. For example sociologists work there. Also there are many electric/electronic and machine engineers.

4.5 Professional and Ethical Issues

Tübitak YTE projects mostly related to government products. Therefore it is important for employees and interns there to be strict about what they do there.

4.6 Impact of Engineering Solutions

Tübitak YTE taught me that there is much to do than coding in a software development process and it is important to be consistent about the process. Tübitak YTE uses agile development methods where the process of development is iterative and subject to changes. I also learned that, the use of correctly deployed software engineering methods increases the efficiency and overall quality a lot.

4.7 Locating Sources and Self-Learning

Since there was a lot of different libraries, frameworks and programming languages in use, my primary source were documentations. I had to go through them in order to find a functionality. But fortunately Tübitak YTE uses widely used and well documented frameworks. My secondary source was Github projects. They helped me a lot, especially while coding with Node.js.

4.8 Using New Tools and Technologies

Tübitak YTE introduced me to a lot of new tools and technologies. First thing I've met is **Postgresql**[3] and **DataBase Management** and how to coup database with Java. Second new technology I was introduced was **Spring Framework**[9].

On the back-end side, I learned about Nodejs, a JavaScript run-time library built on Chrome's V8 JavaScript engine[10] and other JavaScript libraries.

5 Conclusions

To sum up, I mostly worked on web applications, then a little bit on object detection. Object detection part seemed really easy because I learned a lot about PyTorch and OpenCV in Computer Vision class in Hacettepe. I learned a lot about frontend and backend development with JavaScript, React and postgresql, also about Spring Framework, which I used for the first time in Tübitak YTE . Also, I think management of Tübitak YTE is really good in terms of work hours and benefits. I enjoyed my internship there.

6 Appendices

Here you can see Model-Controller-Repository-Service model for alertapp.

AlertController.java

```java
package com.alertsys.alertapp.Controllers;

import com.alertsys.alertapp.Models.Alert;
import com.alertsys.alertapp.Services.AlertService;
import lombok.RequiredArgsConstructor;
import org.springframework.web.bind.annotation.*;

import java.util.HashSet;
import java.util.List;

@CrossOrigin(origins = "http://localhost:3000", allowedHeaders = "*")
@RestController
public class AlertController {

    private final AlertService alertService;

    public AlertController(final AlertService alertService) {
        this.alertService = alertService;
    }

    @DeleteMapping("/alerts")
    public void DeleteAlert(@RequestParam  final String name){
        alertService.DeleteAlert(name);
    }
    @DeleteMapping("/deleteAll")
    public void DeleteAll(){
        alertService.DeleteAll();
    }
    @GetMapping("/alerts/{name}")
    public Alert GetAlert(@PathVariable final String name) {
        return alertService.GetAlert(name);
    }
    @GetMapping("/alerts")
    public List<Alert> GetAlerts() {
        return alertService.GetAlerts();
    }
    @PostMapping("/alerts")
    public void AddAlert(@RequestBody final Alert alert){
        alertService.AddAlert(alert);
    }


}
```

Alert.java

```java
package com.alertsys.alertapp.Models;

import lombok.AllArgsConstructor;
import lombok.Getter;
import lombok.RequiredArgsConstructor;
import lombok.Setter;
```

```java
import org.springframework.beans.factory.annotation.Autowired;

import javax.persistence.GeneratedValue;
import javax.persistence.Id;
import javax.persistence.Entity;
import java.time.LocalDateTime;

@Entity
@Getter
@Setter
@AllArgsConstructor //
@RequiredArgsConstructor
public class Alert {

    @Id
    @GeneratedValue //adds unique id to entity
    private Long id;

    private String name;
    private String url;
    private String method;
    private Long period;


}
```

AlertRepository.java

```java
package com.alertsys.alertapp.Repositories;

import com.alertsys.alertapp.Models.Alert;
import org.springframework.data.jpa.repository.JpaRepository;

import java.util.List;


public interface AlertRepository extends JpaRepository<Alert,Long> {

    Alert findByNameAndUrlAndMethodAndPeriod(String name, String url, String method,
    long period);
    Alert findById(long id);
    Alert findByName(String name);
    List<Alert> findAll();

}
```

AlertService.java

```java
package com.alertsys.alertapp.Services;

import com.alertsys.alertapp.Models.Alert;
import com.alertsys.alertapp.Repositories.AlertRepository;
import org.springframework.stereotype.Service;

import java.util.List;

@Service
public class AlertService {

    private AlertRepository alertRepository;

    public AlertService(final AlertRepository alertRepository){
        this.alertRepository=alertRepository;
    }
    public void AddAlert(final Alert alert){
        if(alert.getName()==null || alert.getName().equals(""))
            return;
        if(alert.getMethod()==null || alert.getMethod().equals(""))
            return;
```

```
22          if(alert.getUrl()==null || alert.getUrl().equals(""))
23              return;
24          if(alertRepository.findByNameAndUrlAndMethodAndPeriod(alert.getName(),alert.
    getUrl(),alert.getMethod(),alert.getPeriod())!=null)
25              return;
26          if(alert.getMethod().equals("POST")||alert.getMethod().equals("GET")||alert.
    getMethod().equals("DELETE")||alert.getMethod().equals("PUT"))
27              alertRepository.save(alert);
28      }
29
30      public void DeleteAlert(final String name){
31          alertRepository.delete(alertRepository.findByName(name));
32      }
33      public void DeleteAlert(final String name,final String url,final String method,
    final long id){
34          alertRepository.delete(alertRepository.findByNameAndUrlAndMethodAndPeriod(
    name,url,method,id));
35      }
36
37      public Alert GetAlert(final  String name){
38          return alertRepository.findByName(name);
39      }
40      public Alert GetAlert(final String name,final String url,final String method,
    final long id){
41          return alertRepository.findByNameAndUrlAndMethodAndPeriod(name,url,method,id)
    ;
42      }
43
44      public List<Alert> GetAlerts() {
45      return alertRepository.findAll();
46      }
47
48      public void DeleteAll() {
49          alertRepository.deleteAll();
50      }
51  }
```

References

[1] CMMI, "Cmmi levels of capability and performance." https://cmmiinstitute.com/learning/appraisals/levels/.

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[9] S. Framework, "Spring: the source for modern java." www.https://spring.io.

[10] Node.js, "Node.js® is a javascript runtime built on chrome's v8 javascript engine.." https://nodejs.org/en/.