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Submitted at
**FAW**

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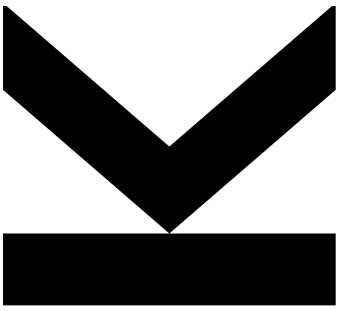
June 2017

# Connecting Small Hydro-Electric Power Stations for Decision Support



Master Thesis

to obtain the academic degree of

Master of Science

in the Master's Program

INTERNATIONALER UNIVERSITA TSLEHRGANG INFORMATICS: ENGINEERING & MANAGEMENT

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# Acknowledgment

# Abstract

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# Chapter 1

# Introduction

## 1.1 Reading Instructions

This thesis may present different interests for different readers. In this chapter, I will provide a guideline explaining what is covered in each chapter in order to facilitate browsing of the thesis and efficiently help every reader find the relevant information for him/her.
The first chapter presents the details and circumstances in which this thesis was created upon. The Problem statement of this thesis will be defined along with the motivation for solving that specific problem. Readers interested in a high level overview of the goal and the approach used for solving the specified problem, along with the original contribution brough to the existing system should refer to the *GoalAndApproach* and *OriginalContribution* subchapters respectively.
The second chapter will discuss the most relevant concept of this thesis, namely decision support systems. They will be discussed and evaluated in terms of the foundations they are built on, their functionality, the Interfaces used for them, how they are implemented and their evaluation matricies and impact on decisions. This chapter will be most relevant for readers who would like to learn about decision support systems and understand the underlying concepts.
The third chapter will cover the Connect Hydro Project that my thesis aims to support and add to it. Connect Hydro proposes a system to connect small, private and independent hydro power plants through networked intelligent control system. In the chapter, I will also give an overview on the device they developed to collect sensor data from the powerplants.
Chapter four will highlight in detail how a decision support system can bring advantage to the connect hydro project. In this chapter, I will also discuss what are the requirments for this proposed decision support system and describe the different inputs along with the expected outputs in addition to what should be the defined rules for such system. This is the chapter that my work will be based on.
The fifth chapter will cover the technical ascpects of the implementation done to support this thesis. It will begin with describing the frameworks and technologies used for the implementation while explaining why they were used. Furthermore, each implemented aspect of the project will be explained in detail, namely the database model, the web portal, the data visualization and finally and most importantly the decision support system. This chapter might be of interest also for readers that want to find more details about the design and implementation of this system.

Chapter six will explain how the system implemented was evaluated, what matricies were used in its evaluation and the results. Readers interested in the results only will find this chapter the most informative for them.
The last chapter containing the conclusion and the future research will be most relevant for users interested in extending and improving the proposed system.

## 1.2 Foreword

Renewable energy is the new trend that all governments are directing research into simply because they are enviroment friendly and cheap. All researchers predict that the earth natural resources will run out and for the past 20 years have been trying to research new techniques to produce energy.[1]

### 1.2.1 Motivation

## 1.3 Problem Statement

## 1.4 Goal and Approach

## 1.5 Original Contribution

## 1.6 Outline of the Thesis

## Chapter 2

# Decision Support Systems

### 2.1 Foundations

### 2.2 Functionality

### 2.3 Interfaces

### 2.4 Implementation

### 2.5 Evaluation and Impact

## Chapter 3

# Connect Hydro Project

**Chapter 4**

# Decision Support in Connect Hydro

## Chapter 5

# System Architecture and Details

### 5.1 Frameworks and Technologies

### 5.2 Database Design and Implementation

### 5.3 Web Portal

### 5.4 Data Visualization

### 5.5 Decision Support

## Chapter 6

# Evaluation

## Chapter 7

# Conclusion

### 7.1 Summary

### 7.2 Lessons Learned

### 7.3 Future Research

#### 7.3.1 Machine Learning

#### 7.3.2 No-SQL Database

# Abbreviations

**API** Application Programming Interface

**I/O** Input/Output

**JDBC** Java Database Connectivity

**JSON** JavaScript Object Notation

**OOP** Object Oriented Programming

**OS** Operating System

**REST** Representational State Transfer

**SQL** Structured Query Language

**XML** eXtensible Markup Language

# Bibliography

[1] Ajila, S., and Al-Asaad, A. Mobile databases - synchronization and conflict resolution strategies using sql server. In *Information Reuse and Integration, 2011. IRI '11. IEEE International Conference on* (2011), pp. 487 – 489.

# Nada Ossama

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## Education

| | |
|---|---|
| Sep 2016 - Present : | Master in Informatics,Johannes Kepler University (JKU)- Graduate July 2017. |
| Sep 2008 – Jul 2012: | Bachelor of *Science,* GPA: 2.76**, German University in Cairo (GUC)* |
| Sep 2005 – Jul 2008: | British IGCSE High school certificate, Grade: 110%, *Egyptian Language School, Cairo* |

**GPA on a scale of 1-5.0, with 1 being the highest GPA possible and 5.0 being the lowest GPA possible.*

## Work Experience and Internships

July 2012 – July 2016: **Customization Engineer**, *Amadeus IT Group*

- Participated in Workshops with Customers to determine their needs and propose a solution
- Wrote functional/technical specification and Solution Architecture documents
- Wrote User Guide and Deployment Guides
- Developed applications as per functional specifications document using .NET framework and Amadeus Web Services, followed by testing and delivering the applications
- Provided second level support and training
- Trained new Members and offered them support

July 2011 – Sep 2011: **Software developer Intern**, *Mash Ltd*

- Worked on Various Applications using Ruby on Rails

July 2010 – Sep 2010: **Database Administration Intern**, *Vodafone Egypt*

- Developed an Enterprise Manager application using Java
- Learned different Types of support by rotating with the support Team

## Technical Skills

| | |
|---|---|
| Programming Languages: | C#, Java, VB.NET |
| Web Technologies: | HTML, JavaScript, Spring, ASP.NET, XML, WPF, Web Services |
| Databases: | MS SQL Server, SQLite, MySQL |
| MS-Office: | Excel, Word, Access, Powerpoint |

## Courses

| | |
|---|---|
| Dec 2012: | Delivering the Extra Mile, *Logic Training & HR Development* |
| Nov 2012: | Amadeus Cryptic Basic Course, *Amadeus IT Group* |
| Sep 2012: | Presentation Skills Course, *Logic Training & HR Development* |

## Extracurricular Activities

| | |
|---|---|
| Feb 2012 – May 2012: | Junior Teaching Assistant, *Introduction to computer science II for 2nd semester management students, German University in Cairo* |
| Feb 2012 – May 2012: | Junior Teaching Assistant, *Introduction to computer programming for 4th semester engineering students,, German University In Cairo* |
| Jul 2011 – May 2012: | Vice-president, *GUC Theater and Cinema School , German University in Cairo* |
| Feb 2011 – May 2011: | Junior Teaching Assistant, *Introduction to computer science for 1st semester management students, German University In Cairo* |
| Feb 2010 – Mar 2010: | Head Of Ushering Team, *Google I/O Event, German University in Cairo* |
| Feb 2010 – Mar 2010: | Planning Team Member, *Google I/O Event, German University in Cairo* |
| Jul 2007 – Jul 2009 : | Events Committee Member, *Flying Colors Team, British Council* |

## Language Skills

Arabic: Mother Tongue
English: Fluent
German: Basic (Learning)

## Awards and Achievements

| | |
|---|---|
| Sep 2016: | Scholarship at the Johannes Kepler University |
| Sep 2007: | Scholarship at the German University in Cairo |

## Hobbies

Sport activities
Reading
Bike Riding
Travelling and discovering new places

Egypt, October 21, 2016

# Eidesstattliche Erklärung

Ich erkläre an Eides statt, dass ich die vorliegende Masterarbeit selbstständig und ohne fremde Hilfe verfasst, andere als die angegebenen Quellen und Hilfsmittel nicht benutzt bzw. die wörtlich oder inhaltlich entnommenen Stellen deutlich als solche kenntlich gemacht habe.

Hagenberg, Juni 2017 Nada Ossama