**Friedrich-Alexander-Universität Erlangen-Nürnberg**
Facultiy of Engineering - Department of Electrical Engineering (EEI)
Chair of Electrical Smart City Systems

Master's Thesis
on the topic

# LPWAN: Deriving the theoretical and practical limitations, and design of an application/ technology matching algorithm

by

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to achieve the academic degree
Bachelor / Master of Science (B.Sc. / M.Sc.)

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# Declaration

I confirm that I have written this thesis unaided and without using sources other than those listed and that this thesis has never been submitted to another examination authority and accepted as part of an examination achievement, neither in this form nor in a similar form. All content that was taken from a third party either verbatim or in substance has been acknowledged as such.

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# Kurzfassung

# Abstract

Introduction to an abstract thesis about the flow of space-time during the creation of any thesis.

# Abbreviations and Acronyms

**CEA** Controlled Environment Agriculture

# Contents

**Kurzfassung** I

**Abstract** III

**Abbreviations and Acronyms** V

**1 Introduction** 1

1.1 Motivation . . . 1

1.2 Problem Statement . . . 1

1.3 Solution Proposal . . . 2

**2 Fundamentals** 5

2.1 Systems Modelling Approach . . . 5

2.2 Agricultural and CEA Basics . . . 5

**3 Theoretical Analysis and Architectural Approach** 7

3.1 Energy Analysis . . . 7

3.2 Presentation of the General Concept . . . 7

3.3 Energy System Architecture . . . 7

**4 Showcase of Example Unit and Simulation** 9

4.1 Introduction to the Simulation Environment . . . 9

4.2 Simulation Architecture . . . 9

4.3 Analysis of Energy Use and Comparison with State of the Art . . . 9

4.4 Results . . . 9

**5 Results and Discussion** 11

**6 Evaluation and Outlook** 13

**List of Figures** 15

**List of Tables** 17

# Chapter 1

# Introduction

Lorem ipsum ... This is some sample text.
This is more sample text :). And I have even more sample text. Test.

**Figure 1.1:** Image caption

Lorem ipsum ...

## 1.1 Motivation

The motivation for this work is threefold. One, crafting ideal human environment in the context of smart city. - Taking advantage of synergies. Two, resilience and national autonomy of food supply. - Preparedness for shifting climate. Three, most important to the author, global sustainability of human civilization. - water use - pesticide use and water ?artrification? - local food production - freeing up area for natural ecosystems

?Mehr auslegen einer Vision? - Imagine the future city. Clean green walls dampen the sound of cars, provide cooling in the hot summer months.

## 1.2 Problem Statement

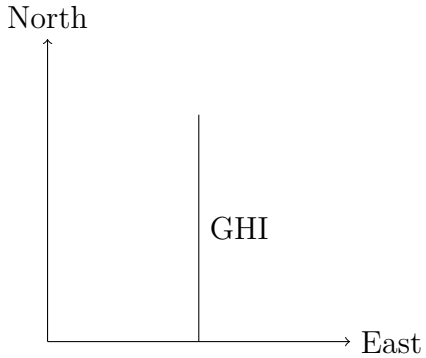
From the three main motivations laid out before we can extract the main problems of these areas. One - Air quality - disconnection from nature - buildings not properly insulated, taking advantage of synergies. Two - Reliance on a few agricultural plentiful

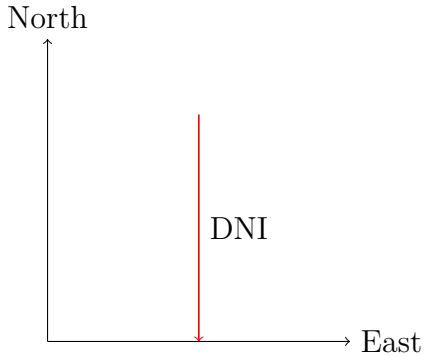
areas in the world to sustain the hunger of the human population - These might change as climate patterns will shift. Three - High resource use of cities. Uncertainty of future climate. This section laid out a number of different problems. This work can not adress all, but tries to connect

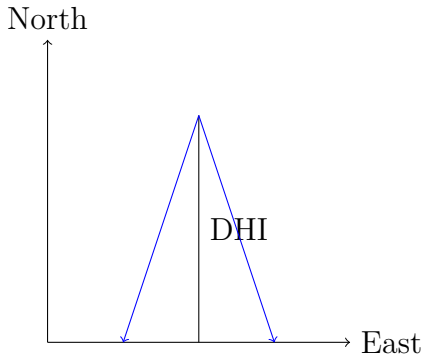
Let us first examine current Controlled Environment Agriculture (CEA) and vertical farming approaches to get a better understanding of the solution methods and shortcomings. Current solutions try to achieve high degree of automation and full control over the environment. This results in high energy

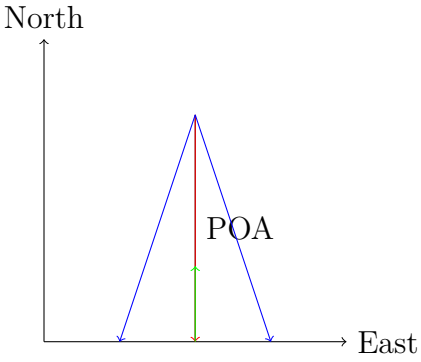
## 1.3 Solution Proposal

First we shall look - Gliederung der Arbeit




North
POA
East

# Chapter 2

# Fundamentals

## 2.1 Systems Modelling Approach

## 2.2 Agricultural and CEA Basics

# Chapter 3

# Theoretical Analysis and Architectural Approach

## 3.1 Energy Analysis

## 3.2 Presentation of the General Concept

## 3.3 Energy System Architecture

# Chapter 4

# Showcase of Example Unit and Simulation

## 4.1 Introduction to the Simulation Environment

## 4.2 Simulation Architecture

## 4.3 Analysis of Energy Use and Comparison with State of the Art

## 4.4 Results

# Chapter 5

# Results and Discussion

# Chapter 6

# Evaluation and Outlook

# List of Figures

1.1 Image caption . . . . . 1

# List of Tables