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Peer Observations of Observation Units

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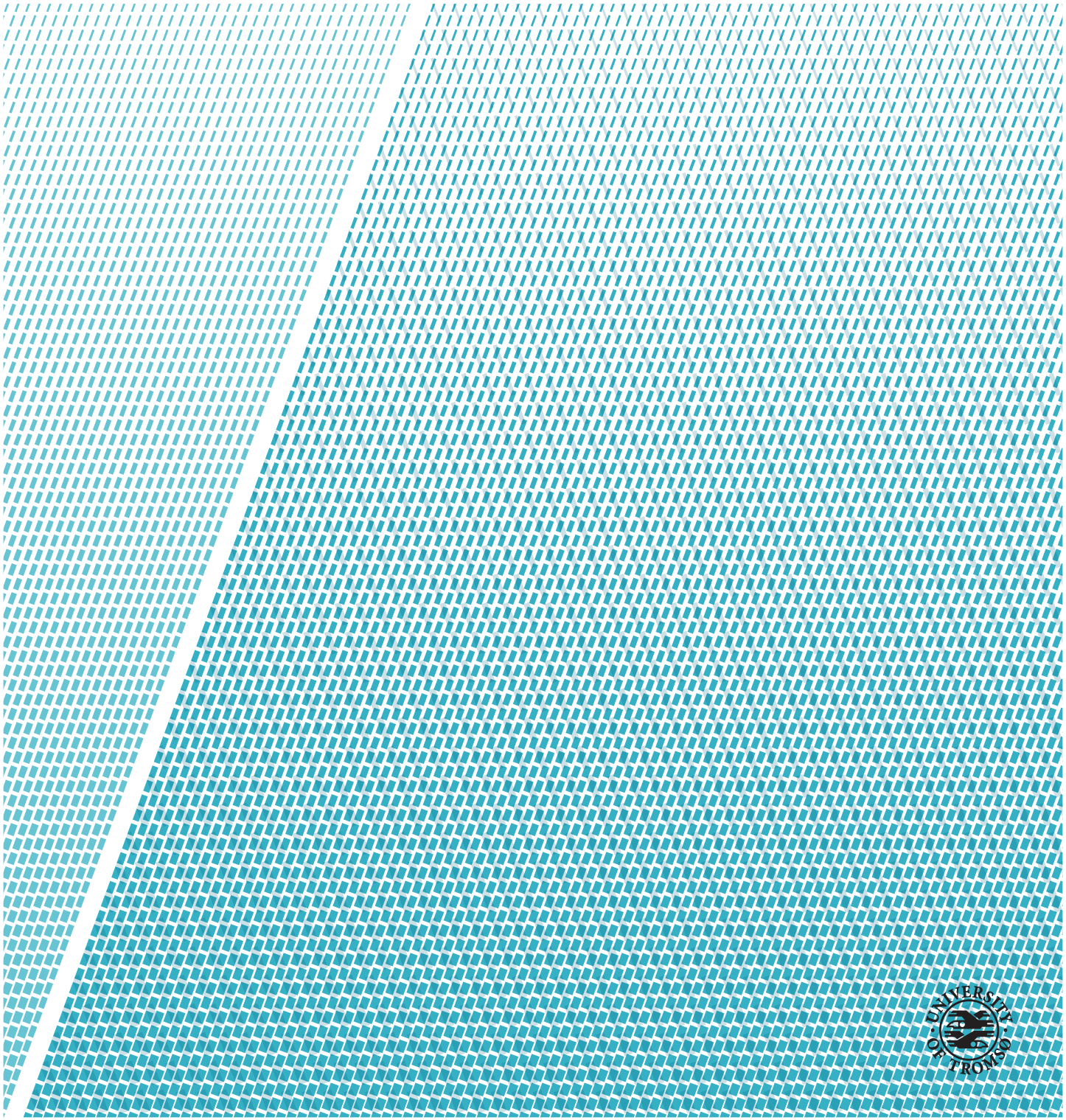

Abstract

What is wrong with the world? Motivation 1-3 sentences, Arch, Des, Imp, Exp 1,2-3 sentences, results and main conclusion.

Acknowledgements

Contents

1 Introduction

FRA CAPSTONE: The Arctic tundra in the far northern hemisphere is challenged by climate changes in the world today and is one of the ecosystems that are most affected by these changes[10]. The Climate-ecological Observatory for Arctic Tundra (COAT) is a long-term research project developed by five Fram Center[1] institutions. Their goal is to create robust observation systems which enable documentation and understanding of climate change impacts on the Arctic tundra ecosystems. COAT was in autumn 2015 granted substantial funding to establish research infrastructure which allowed them to start up a research infrastructure during 2016-2020[10].

Wireless Sensor Network (WSN) is a system that consists of hundreds or thousands of low-cost micro-sensor nodes. These nodes monitor and collect physical and environmental conditions. The various activities in the sensor nodes consume lots of energy and the battery of the sensor node is difficult to recharge in wireless scenarios and also because the sensor nodes are located at remote areas in the Arctic tundra.

This thesis presents the architecture, design and implementation of a peer observation that can observe and accumulate data from in-situ observation units.

1. http://www.framsenteret.no/english

1.1 Motivation

The motivation behind this project is...

The purpose is to fetch and accumulate data observed by observation units for further use.

The observation units to be used for the prototype comprises Observation Unit Processes executing on PCs and/or Raspberry Pi.

1.2 Contributions

The dissertation makes the following contributions:

- A
- B

1.3 Assumptions

Avgrense viktig!

1.4 Limitations

Avgrense viktig!

1.5 Outline

This thesis is structured into X chapters including the introduction.

Chapter 2 describes ..

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter X

2

Routing Techniques in WSNs?

Som eget kapittel eller ha det under Related Work? Si noe om routing protocols som hierarchical (evt flat-based og location-based) og si noe om routing protocol operations som multipath (evt. query-based, QoS-based, coherent-based etc..)?

Har også fra WSN-bok ("Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willig) kap. 11 som heter "Routing Protocols" som sier noe om gossiping, energ-efficient unicast, broadcast/multicast, geographic routing og mobile nodes..

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Related Work

Wireless sensor networks main task is to periodically collect information of the interested area and broadcast the information to a Base Station (BS). An easy approach to achieve this task is to make each sensor node transmit their data directly to the BS. But the problem is that the BS can be far away from the sensor node and the sensor node will die due to energy consumption. LEACH, PEGASIS, TEEN and APTEEN are different hierarchical protocols that has been proposed as solutions to this problem [3][4].

LEACH [1] introduce a hierarchical clustering algorithm for sensor networks. It is self-organized and use randomization to distribute the energy load evenly among the sensors in the network. The sensor nodes organize themselves into local clusters where one node is the local BS or Cluster Head (CH). The CH are not fixed to avoid nodes to drain their battery and to spread the energy usage over multiple nodes. The nodes self-elect a new CH depending on the amount of energy left at the nodes at different time-intervals. LEACH is divided into different rounds where each round include a setup phase and a steady-state phase [4]. In the setup phase will each node decide whether to become a CH or not. When a CH is chosen, each node will select its own CH based on the distance between the node and the CH and join the cluster. In the steady-state phase will the CH fuse the received data from the node members in the cluster and send it to BS.

PEGASIS is a chain-based protocol with the idea to form a chain among the sensor nodes so each node will receive from and transmit to a close neighbor.

The sensor nodes will also take turns on being the leader for transmitting data to the BS and therefor distribute the energy load evenly among the sensor nodes. The chain can be organized by the nodes themselves using a greedy algorithm starting from some node or the BS can compute the chain and broadcast it to all the nodes in the network [6].

Fuzzy logic is also a suitable problem-sovling control system methodologi [8].

CH were elected by the BS in each round by calculating the change each node has to become the CH using three fuzzy descriptors [9].

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Architecture

Tell it clean/neat. Abstractions, functionalities

4.1 Abstraction..?

4.2 Data Transmission?

4.2.1 Node lookup service?

5

Design

Server, p2p, protocols..

5.1 Broadcasting?

5.2 Data Transmission?

5.2.1 Base Station Access?

5.2.2 Cluster Leader?

5.3 Leader Election?

5.4 Accumulate Data?

6

Implementation

Threads, data structures, language

This chapter will elaborate on how we implemented the system, general implementation requirements, issues and choices.

The system is implemented in the open source programming language GO 1.9.3[1].

$$d = \sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)^2} \tag{6.1}$$

$$T(n) = \frac{P}{1 - P \times (r \bmod \frac{1}{P})} \tag{6.2}$$

$$T(n) = \begin{cases} \frac{P}{1-P\times(r \bmod \frac{1}{P})} & if n \in G \\ 0 & otherwise \end{cases} \tag{6.3}$$

$$P_i(t) = \min\left\{\frac{E_i(t)}{E_{total}(t)}k, 1\right\} \tag{6.4}$$

1. `https://golang.org/`

7 Evaluation

This chapter describes the experimental setup and metrics used to evaluate the implemented system.

7.1 Experimental Setup

All experiments were done on a Lenovo ThinkCenter with the following specifications:

- Intel® CoreTM i5-6400T CPU @ 2.20GHz × 4
- Intel® HD Graphics 530 (Skylake GT2)
- 15,6 GiB memory and 503 GB disk
- Ubuntu 17.04 64-bit with gcc V6.3.0 compiler and GO 1.9.3

7.2 Experimental Design

How did we do the experiments?

7.3 Results

What does the results say?

7.3.1 Result 1

7.3.2 Result 2

7.3.3 Result 3

8

Discussion

Idea, arch, design, results, other solutions, "arch has scale issue"..

This chapter discusses our approach, experience, how we solved the problem and why we chose the solution we ended up with...

8.1 Availability of nodes in the system?

8.2 Cluster-head Election?

8.3 Data Transmission?

9

Conclusion

In this thesis, we have implemented a system/prototype...

Our experiments showed that the system ...

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Future Work

11

Appendix

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