DTU Compute
Department of Applied Mathematics and Computer Science

Tether Control for Unmanned Aerial Vehicle

A *nice* thesis template

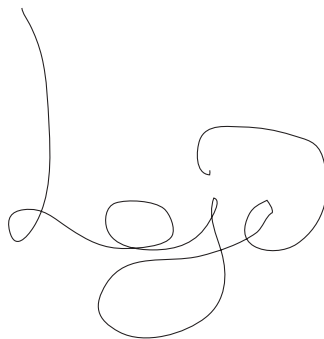Peter Juhl Savnik (s113556)

Kongens Lyngby 2014

Summary

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Preface

This bachelor thesis was prepared at the department of Automation and Control at the Technical University of Denmark in fulfillment of the requirements for acquiring a bachelor degree in Elektrical Engineering.

Kongens Lyngby, October 20, 2014

Peter Juhl Savnik (s113556)

Acknowledgements

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Todo list

CHAPTER 1

Introduction

UAV har længe kun været brugt til militære, forskning og hobby formål - men den seneste tid har en læng række industrielle applikationer set et potentiale i at bruge UAV's til industrielle formål. Flyvende droner er blevet implementeret i en lang række applikationer såsom, overvågning, fotografering/filmoptagelser, opmålinger af landskab og meget mere.

For et sådan system skal kunne være i drift i længere tid af gangen er der behov for en konstant strømforsyning via et kabel. Dette projekt handler om at udvikle en platform til håndteringen af UAV og kablet. En løsning skal ikke begrænses til at løse et enkelt problem men ses som en platform for implementering af tøjret droner i en bred række applikationer.

1.1 Problem formulation

Formålet med projektet er at udvikle en platform for tøjret UAV's samt at forslå en design løsning.

1.2 Problem limitation

- UAV skal være i stand til at holde sig operationel i længere tid af gang. Det skal ses i forhold til et batteridrevet alternativ.

- Forankringspunkter har en væsentlig større masse end UAV'en kan trække og vi derfor udelukker alle situationer hvor dronen trækker forankringspunktet.

1.3 Eksempel

I Danmark udgører landbrugets kornproduktion 35% af Danmarks samlede areal eller 1.495.000 ha til en værdi på 29,4 mia. kr. der produceres i stigende grad mere med mindre ressourcer. Organisationen Landbrug og Fødevarer sætter et stor fokus på at optimere produktionen gennem forskning og innovation.

Et velkendt problem i korn produktionen er når landmanden høster i skovbrynet, ligger der ofte ungt vildt og trygger sig i kornet. Deres naturlige instinkt på fare er at trygge sig endnu mere. Det vil sige at når landmanden høster sin mark, flytter

1.0 (1) Giv projektet et overordnet navn, midlertidigt navn: PTD-Platform for Tethert Drone

1.0 (2) introducer UAV forkortelse

1.3 (3) Kilde Landbrug og Fødevarer

dyret sig ikke for maskinen. Det resultere i et stort antal ung vildt som bliver påkørt af landmændene. Det har økonomiske konsekvenser for landmanden, i og med at det høstede korn bliver ødelagt, der kan ske materieller skader på udstyret, nede tid i driften og ikke mindst er det en ubehagelig oplevelse for landmanden.

En forsknings gruppe på DTU Automation har forslået en løsning med en drone der flyver foran køretøjet og med et vision-system kan detektere eventuelle forhindringer.

Analysis

2.1 Background

Det ønskes at udvikle en platform for styring af tøjret droner - PTD Platform for Tethered Drones. En sådan platform kan have mange anvendelsesmuligheder i den industrielle verden - hvilket også sætter en række krav til pålidelighed og robust design.

PTD - Platform for Tethered Drones

Præsentation over-all-system

Physical model

Electrical loss

We assume that UAV requires 500W when using maksimal thrust. To be on the safe side we put in a tolerance on 10%, ending up with supplying the UAV with 550W. The loss in the cable can now be calculated as following.
P is the power in Watt, U is the voltage in Volt, l is the distance in meter, ρ is the eletrical resistivity in $\Omega \cdot m$ and A is the cross sectional area in m^2.

The current $I[A]$ through the wires is given by the power over the voltage.

$$I = P/U \tag{2.1}$$

The resistance $R[\Omega]$ per unit length is to be determined by the electrical resistivity $\rho[\Omega \cdot m]$ over the conductors cross sectional area.

$$R = \frac{\rho}{A} \tag{2.2}$$

The voltage drop $U_{drop}[V]$ per unit length is to be determined by the current times the resistance.

$$U_{drop} = I \cdot R \tag{2.3}$$

The cable loss $P_{loss}[W]$ per unit length is now given by

$$P_{loss} = I^2 \cdot R \tag{2.4}$$

Design krav/kravspecifikation

- Sypply the UAV with 120VDC and 500W

- The weight of the cable must not be greater than the lifting cabability.

-

Løsningsforslag

CHAPTER 3

Prototype

Long chapter title with π, very long title

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Sans serif testing:

- π

-

- π

- *italic*
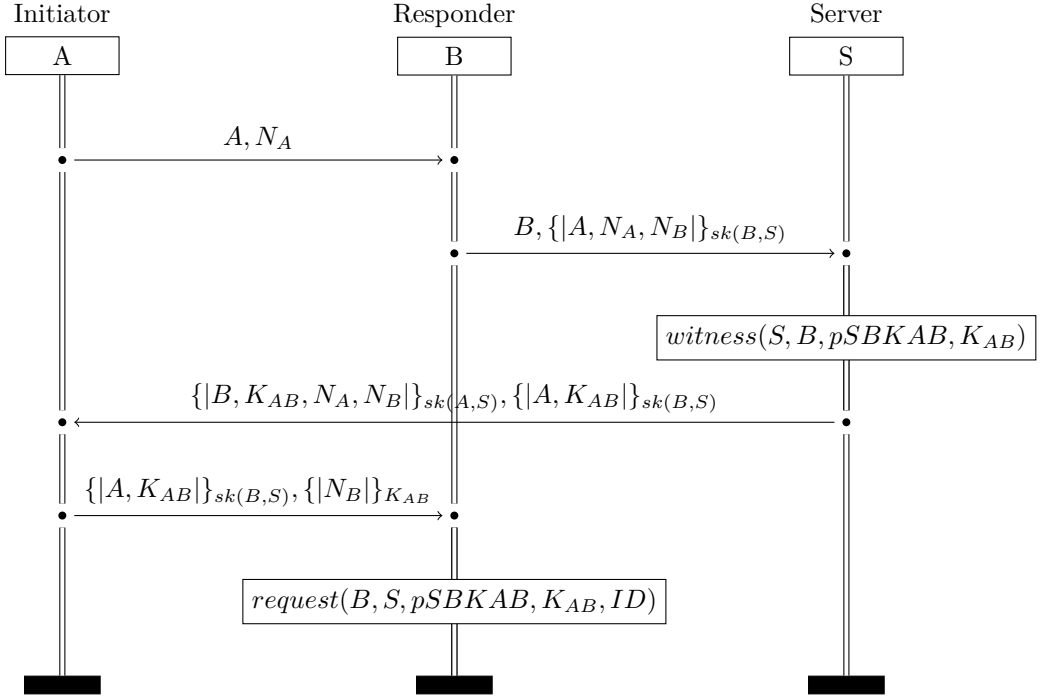
- ***bold italic***

- **bold**

- `teletype`

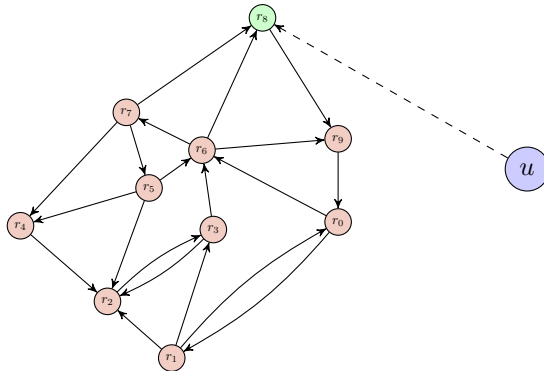**Figure 4.1:** Attack against the goal "B weakly authenticates S on KAB".

Figure 4.2: Initial topology of sensor network. r_n is a regular node, u is the user. Edges represent how the nodes know each other.
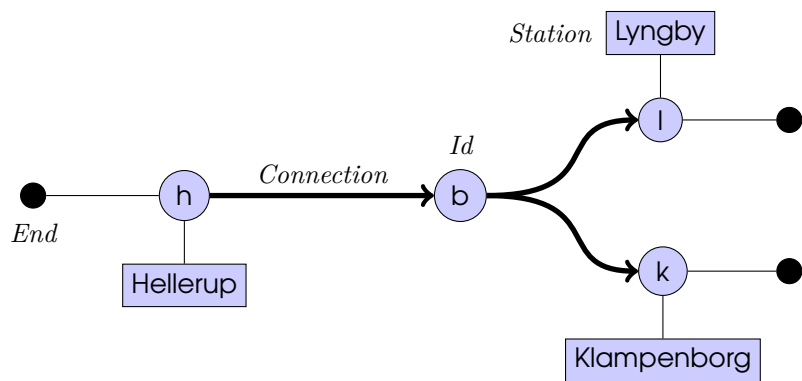
Figure 4.3: Objects in the intermediate network graph.

Heading on Level 0 (chapter)

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

5.1   Heading on Level 1 (section)

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Heading on Level 2 (subsection)

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Heading on Level 3 (subsubsection)

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Heading on Level 4 (paragraph)   Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

5.2   Lists

Example for list (itemize)

- First item in a list
- Second item in a list
- Third item in a list
- Fourth item in a list
- Fifth item in a list

Example for list (4*itemize)

- First item in a list
  - First item in a list
    * First item in a list
      · First item in a list
      · Second item in a list
    * Second item in a list
  - Second item in a list
- Second item in a list

Example for list (enumerate)

1. First item in a list

2. Second item in a list

3. Third item in a list

4. Fourth item in a list

5. Fifth item in a list

Example for list (4*enumerate)

1. First item in a list

   a) First item in a list

      i. First item in a list

         A. First item in a list
         B. Second item in a list

      ii. Second item in a list

   b) Second item in a list

2. Second item in a list

Example for list (description)

First item in a list

Second item in a list

Third item in a list

Fourth item in a list

Fifth item in a list

Example for list (4*description)

First item in a list

    First item in a list

        First item in a list

            First item in a list

            Second item in a list

        Second item in a list

    Second item in a list

Second item in a list

CHAPTER 6

Conclusion

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APPENDIX A

An Appendix

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Bibliography