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Escola Tècnica Superior d'Enginyeria
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Work-flux optimization for the use of GRASP algorithm in quasi-real-time

Master Thesis
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by
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Abstract

Every copy of the thesis must have an abstract. An abstract must provide a concise summary of the thesis. In style, the abstract should be a miniature version of the thesis: short introduction, a summary of the results, conclusions or main arguments presented in the thesis. The abstract may not exceed 150 words for a Degree's thesis.

1 Introduction

An Introduction that clearly states the rationale of the thesis that includes:

1. Statement of purpose (objectives).
2. Requirements and specifications.
3. Methods and procedures, citing if this work is a continuation of another project or it uses applications, algorithms, software or hardware previously developed by other authors.
4. Work plan with tasks, milestones and a Gantt diagram.
5. Description of the deviations from the initial plan and incidences that may have occurred.

The minimum chapters that this thesis document should have are described below, nevertheless they can have different names and more chapters can be added.

1.1 Gantt Diagram

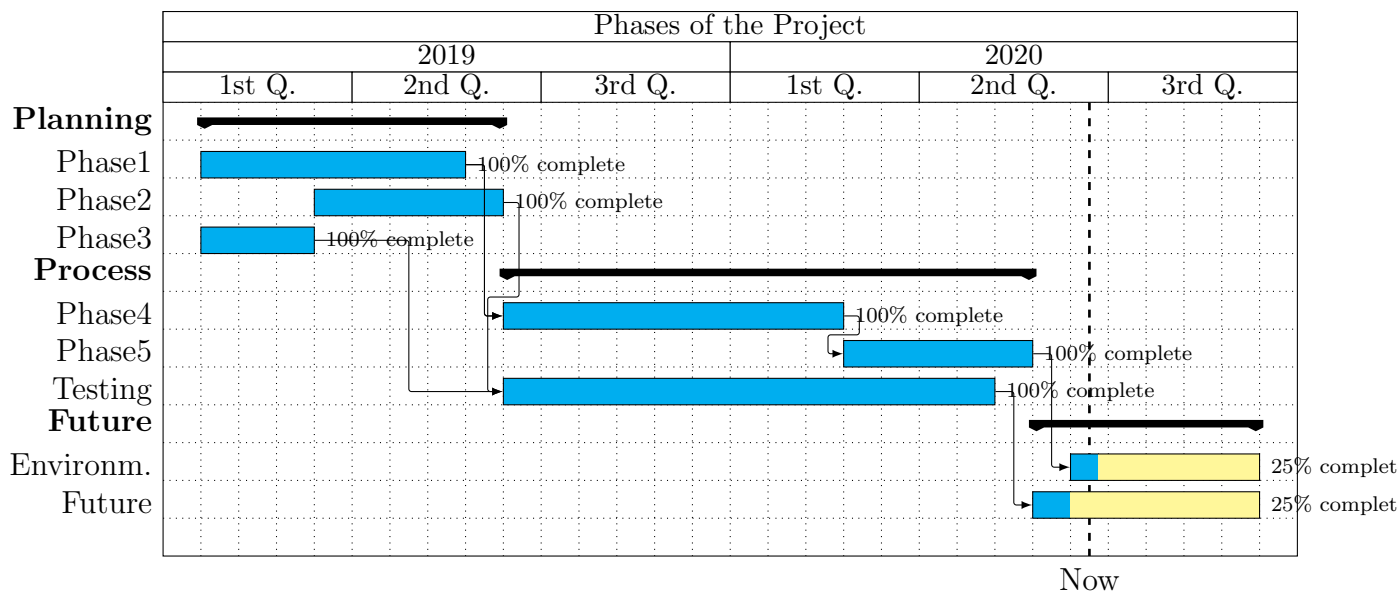


Figure 1: Gantt diagram of the project

For more information read the manual [1] of Skala.

1.2 Topic

2 State of the art of the technology used or applied in this thesis:

A background, comprehensive review of the literature is required. This is known as the Review of Literature and should include relevant, recent research that has been done on the subject matter.

2.1 Topic

Here you have a couple of references about LaTeX [3] and electrodynamics [2].

2.2 Topic

3 Methodology

In order to create a new application , it is necessary to follow the following steps, to create a strong foundation.

- Create a list of requirements
- Research and plan
- Design the architecture
- Design the graphical user interface (GUI)
- Set up development environment
- Implement
- Test
- Deployment
- Maintenance

For the development of the application, it has been decided to use an hybrid structure, using Object Oriented Programming (OOP) with C# and MATLAB scripting.

The main advantages of using C# with OOP are that it allows the code to be reusable, organized and easy to maintain [7]. In this project, it has been used for the development of the Graphical User Interface and the controllers for both, web services and MATLAB script management.

In the other hand, MATLAB provides a specialized environment for numerical calculations, simulations, and complex data analysis[8]. Working directly with matrixes and arrays makes the data processing and visualitzation easier and more efficient.

4 List of requirements

This first step is crucial for the correct result. It is needed to define a clear and well defined list of requirements. This defines the main scope of the project, the different futures to be implemented and prevents from building something that is not desired. This project, need to be able to fulfill the following requirements:

1. Application can be executed in CALCULA operating system (Linux)
2. Download measurements from the internet
 - (a) Download measurements from a defined date range
 - (b) Download measurements from a defined location
 - (c) Download measurements from the Actris-Earlinet Data Portal [5]
 - Download ELPP products
 - Download Optical products
 - (d) Download measurements from the Aeronet web [6]
 - Download Raw Almucantar Sky Scan Radiance measurements
 - Download Raw Hybrid Sky Scan Radiance measurements
 - Download Raw Principal Plane Sky Scan Radiance measurements
 - Download Raw Polarized Principal Plane Sky Scan Radiance and Degree of Polarization measurements
 - Download Raw Polarized Almucantar Sky Scan Radiance and Degree of Polarization measurements
 - Download Raw Polarized Hybrid Sky Scan Radiance and Degree of Polarization measurements
 - (e)
3. Filter Earlinet measurement files depending on the the data type
 - (a) 002, 008
 - (b) 007
4. Execute full GRASP algorithm sequence:
 - (a) Preprocessing:
 -
 -
 -
 -

- - (b) Retrieve aerosol optical depth
 - (c) Retrieve aerosol extinction
 - (d) Retrieve aerosol single scattering albedo
 - (e) Retrieve aerosol Ångström exponent
5. Execute the GRASP algorithm
 6. Give the user the possibility to plot the different results after executing the algorithm
 7. Application can work with project/workspaces
 - (a) User can create, open and import a project
 - (b) Downloaded data from web services are stored in the project folder
 - (c) Results of the GRASP algorithm are stored in the project folder
 - (d) Once a project is closed, all the data is deleted
 - 8.
 - 9.

5 Research and plan

This second step helps optimize both time and resources by preventing unnecessary work. Since this project builds upon a previous one, it is not required to develop new code for certain application requirements. Furthermore, the availability of APIs for downloading measurements from the ACTRIS–EARLINET Data Portal [5] and AERONET web application [6] provides a convenient and efficient solution that can significantly reduce development effort.

5.1 Web services development

5.2 Matlab controller development

6 Architecture

6.1 Tools

- MVVM
- SOLID principles

6.2 Project architecture

7 Graphic User Interface (GUI) design

8 Implementation

8.1 Set up development enviroment

9 Testing

10 Results

This should include your data analysis and findings

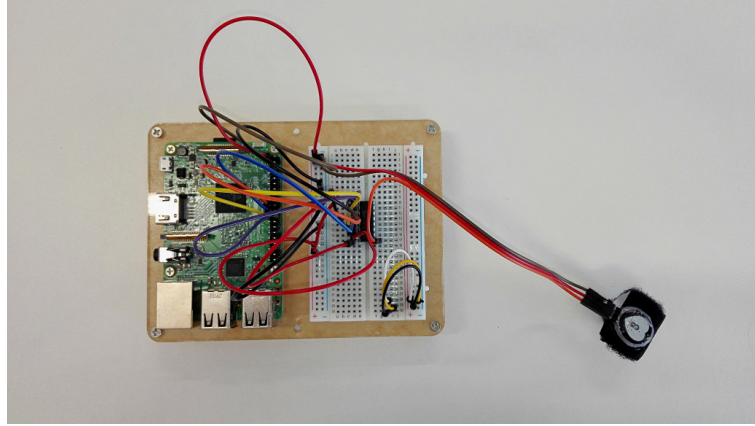


Figure 2: Prototype setup.

Table 1: This is the other caption. Since the trial size of the experiments showed is one second, the number of *Target* and *Impostor* data corresponds to number of trials or seconds

Dataset	Label	Train	Validation	Develop	Test
First	Target	135	45	30	30
	Impostor	5,220	1,740	1,890	2,880
	#Subjects	31			12
Second	Target	144	80	48	48
	Impostor	2,014	1,119	1,343	1,545
	#Subjects	15			5

Algorithm 1 Temperature-Distributed algorithm

```

1: procedure TEMP-SPREAD( $GN_i, HN_j, temperatures$ )  $\triangleright$  Lowest temperature priority
2:    $temperature\_list \leftarrow short(temperatures)$ 
3:    $max\_temperature \leftarrow max(temperature\_list)$ 
4:    $ThresHold \leftarrow 0.5$ 
5:    $temperature\_impact \leftarrow 0.2$ 
6:   for  $GN_i$  in  $i = 1, 8$  do  $\triangleright$  Iterate every hardware node on the given GN
7:      $it\_temperature \leftarrow temperature\_list(GN_i)$ 
8:      $temp\_weight \leftarrow \frac{max\_temperature - it\_temperature}{max\_temperature} * temperature\_impact$ 
9:      $\omega(Master - GN_i) \leftarrow ThresHold * temp\_weight$ 
10:    for  $HN_j$  in  $j = 1, n$  do
11:      if  $available\_accel_{i,j} > busy\_accel_{i,j}$  then
12:         $policy_\omega = \frac{AvailableHW}{TotalHW} * ThresHold$ 
13:         $\omega(GN_i - HN_{i,j}) \leftarrow ThresHold + policy_\omega$ 
14:      else
15:         $\omega(GN_i - HN_{i,j}) \leftarrow 1$ 
16:     $node \leftarrow find\_djistra\_shortest\_path(Master\_Node, aux\_node)$ 
17:    return  $node$   $\triangleright$  The gcd is b
  
```

11 Conclusions

References

- [1] Wolfgang Skala. Drawing gantt charts in latex with tikz.
- [2] Albert Einstein. Zur Elektrodynamik bewegter Körper. (German) [On the electrodynamics of moving bodies]. *Annalen der Physik*, 322(10):891–921, 1905.
- [3] Michel Goossens, Frank Mittelbach, and Alexander Samarin. *The L^AT_EX Companion*. Addison-Wesley, Reading, Massachusetts, 1993.
- [4] Donald Knuth. Knuth: Computers and typesetting.
- [5] C.N.R. IMAA. Actris-earlinet data portal. Web Application available at <https://data.earlinet.org/earlinet/desktop.zul>, 2024.
- [6] NASA. Aerosol robotic network (aeronet). Web Application available at <https://data.earlinet.org/earlinet/desktop.zul>, 2025.
- [7] Miriam Martínez Canelo. ¿qué es la programación orientada a objetos? Web Application available at <https://profile.es/blog/que-es-la-programacion-orientada-a-objetos/>, 2025.
- [8] MathWorks. Matlab. Web Application available at <https://es.mathworks.com/products/matlab.html>, 2025.

Appendices

Appendices may be included in your thesis but it is not a requirement.