

Thesis and Literature review pitch

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Student ID : 6143415

5-6-2024



Agenda | 5x

00

Introduction

01

Robot Platform
Overview

02

Current System
Implementation,
practical
challenges

03

Literature
Review

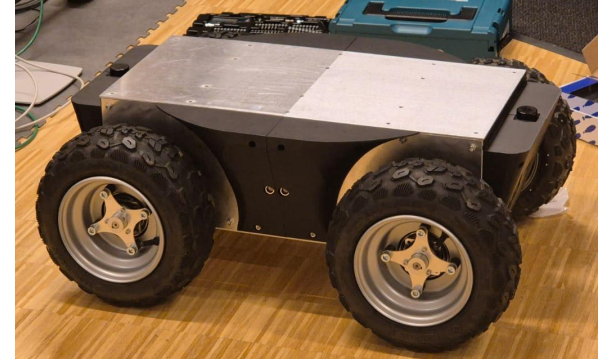
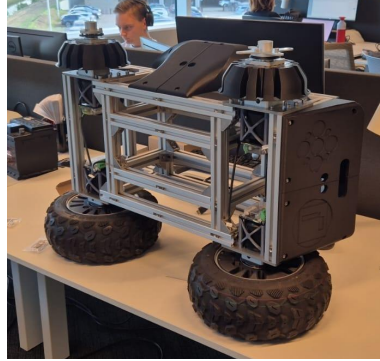
04

Research
direction

01

The Robot Platform

The Robot Platform



Hardware:

- Skid steer Robot
- Odrive S1 motor controllers (CAN)
- Intel RealSense RGB-D
- IMU Adafruit BNO085

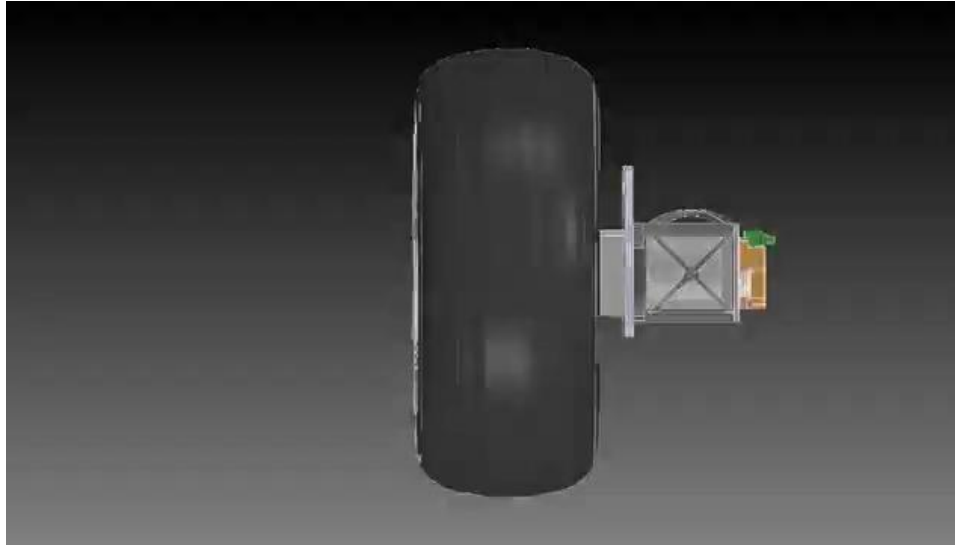
Compute:

- Powered by Nvidia Jetson Orin Nano / SSD for storage
- running OS JetPack 6.2(Ubuntu 22.04)

The Robot Platform



The Robot Platform

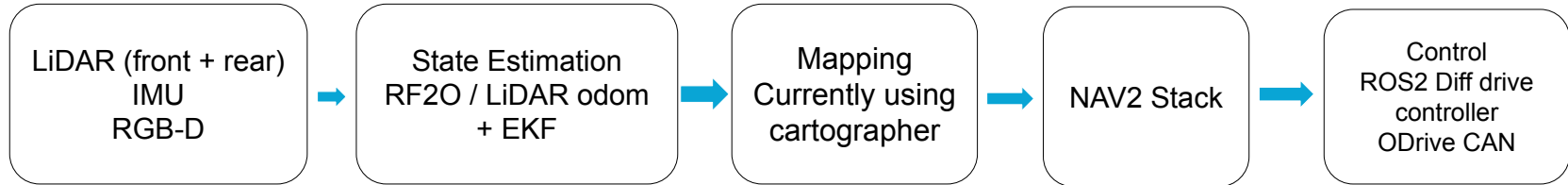


Exploded wheel view with gearbox assembly

02

Current system Implementation and practical challenges

Current Implementation pipeline



What works so far ?

- Teleoperation
- LiDAR odometry working
- ROS2 Integration
- Navigation Stack running
- Robot able to move autonomously



Practical Difficulties Encountered

Problems:

Hardware challenges

- ODrive instability at high loads
- Unreliable odometry

Perception challenges

- LiDAR occlusions
- Sensor drift

Navigation challenges

- Local planner instability
- Difficulty navigating narrow spaces

Fix:

ODrive Faults

- Controller tuning and fault analysis

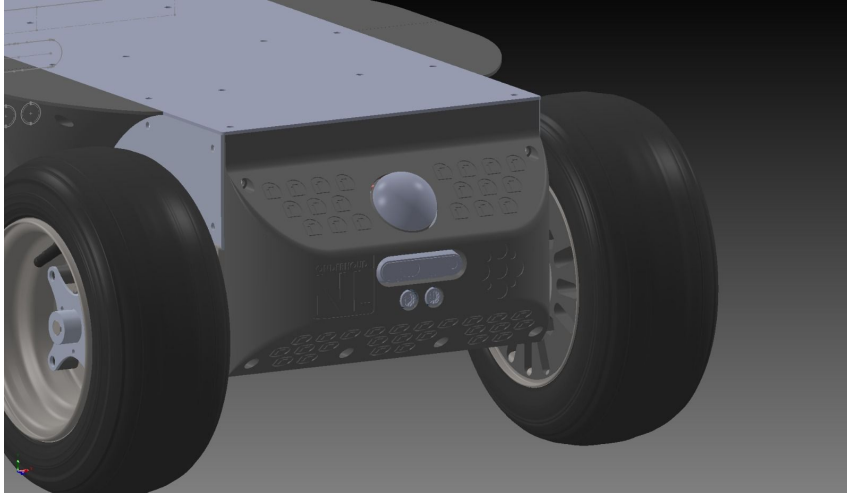
LiDAR occlusions

- AiRY LiDAR + FAST-LIO-2

Unreliable Odometry

- LiDAR inertial odometry

Casing to accommodate new LiDAR



03

Literature Review

Literature Review

- Interest in sampling based stochastic optimal control methods for robot navigation
- Model Predictive Path Integral Control as a promising approach for handling uncertainty and dynamic environments.
- Currently Studying work on 3D aware MPPI, which incorporates environment structure into trajectory sampling.
- Integrate with LiDAR based perception (FAST LIO + Point cloud map)
- Compare with classical controllers and planners.

04

Research Direction

Research Direction

- Begin and complete the literature review on MPPI based navigation (target: April - May)
 - Secured long term access to the robot platform (~1 year)
 - Develop a real world testing environment near RoboHouse
 - Address networking and communication constraints during outdoor experiments
 - Aim for a practical and socially relevant autonomous navigation system
 - If the current platform becomes unavailable due to some technical issues, can we conduct experiments on the clearpath Husky UGV, and also is it okay to close the thesis with a simulation ?
 - Also interested in exploring reinforcement learning
-
- Open for suggestions
 - Am I heading in the right direction ?

Research Direction



Ideally what I would love to do if everything goes well

Thank You for your time

Agenda | 10x

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Introduction:

- Msc Robotics 2nd year
- Software Engineer @ Robohouse



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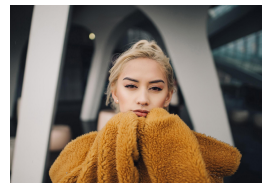
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**Bedankt voor
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Subtitle | Name speaker

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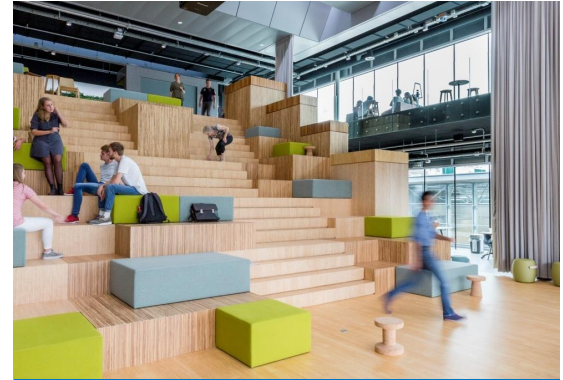
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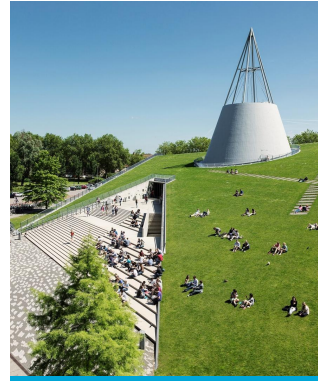
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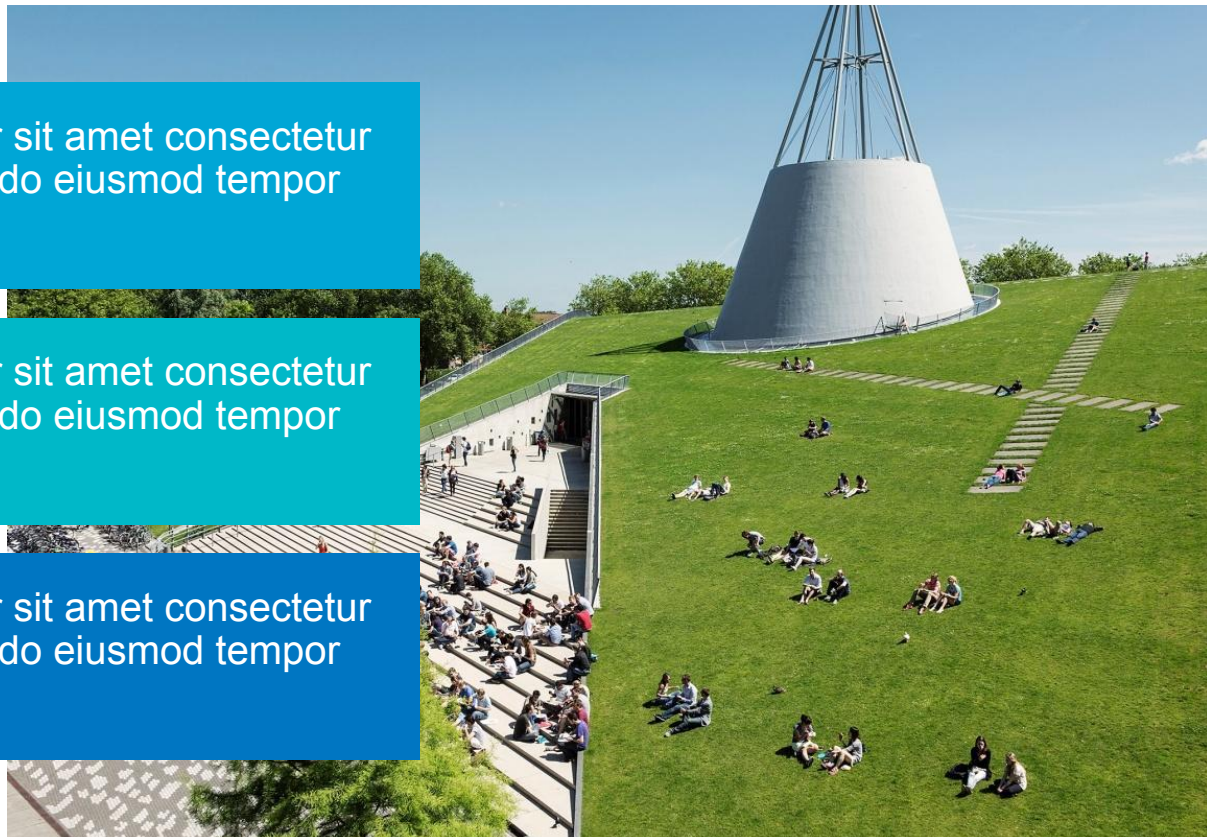
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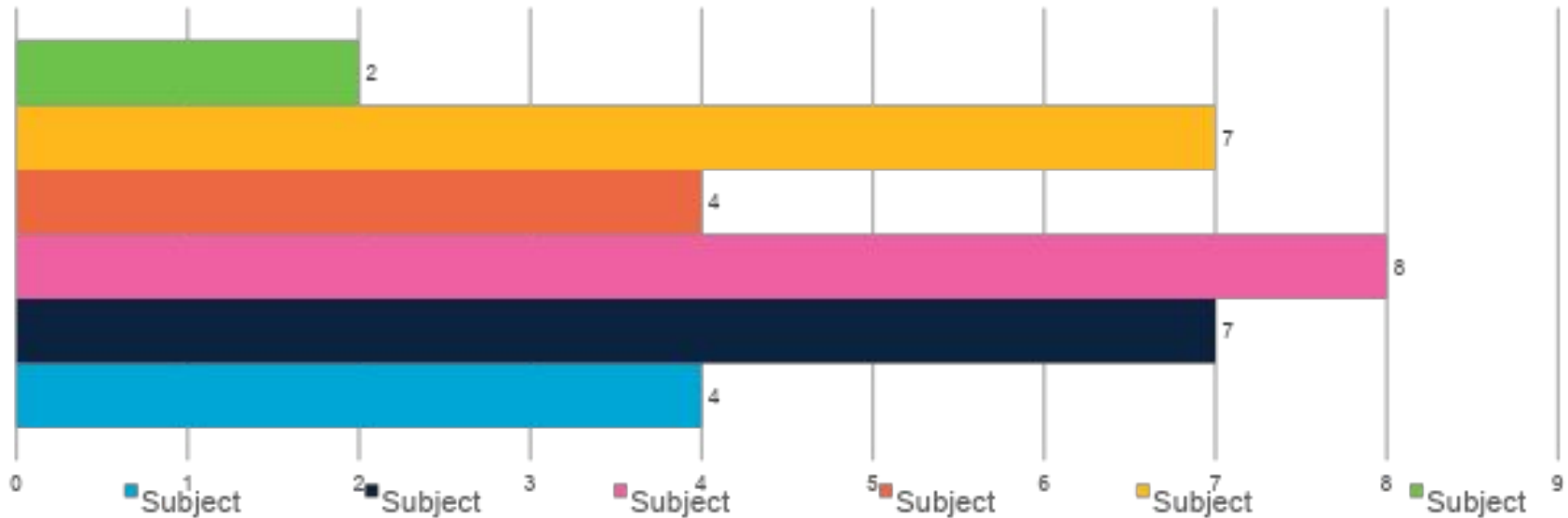
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Bar graph

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Line graph

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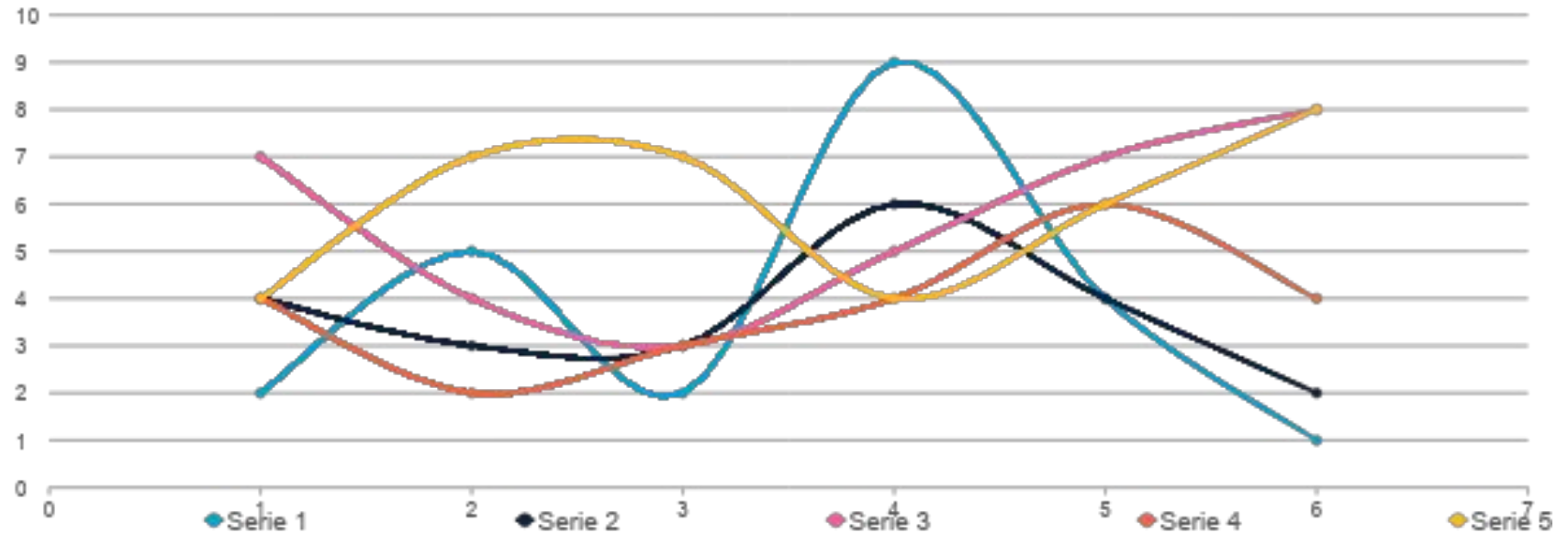


Diagram + text

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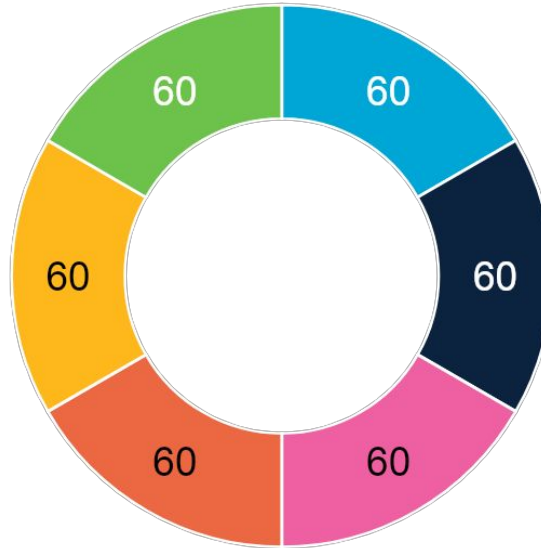
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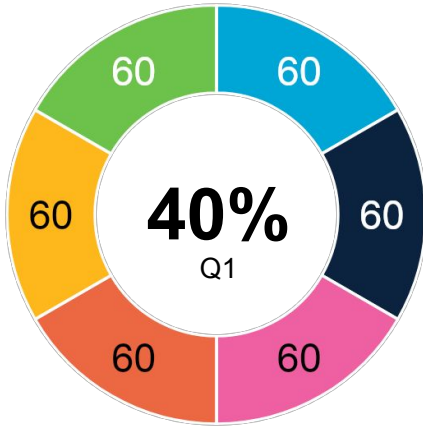
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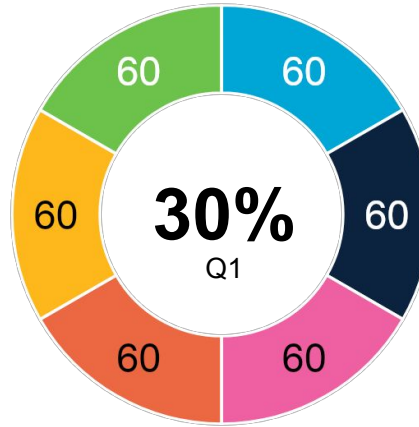
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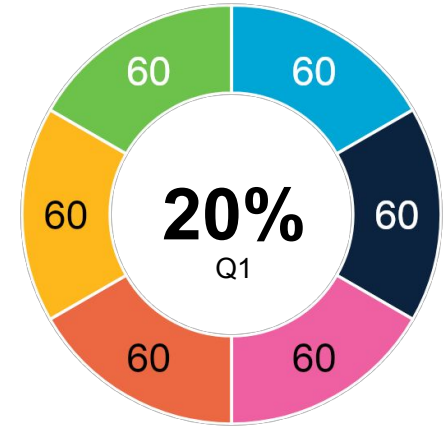
Diagram | 3x



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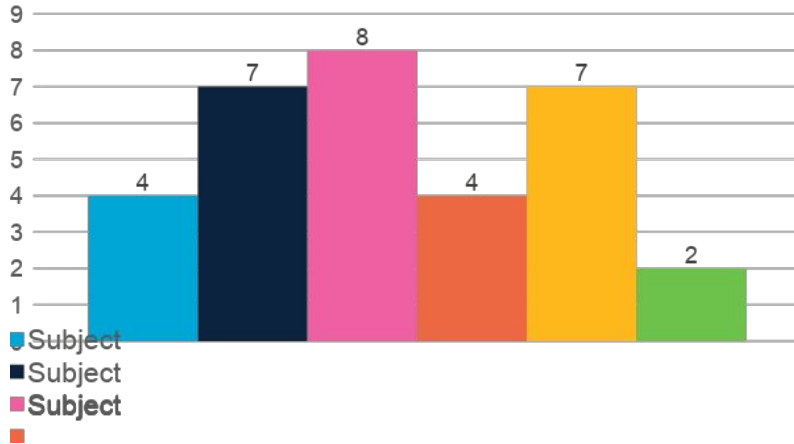
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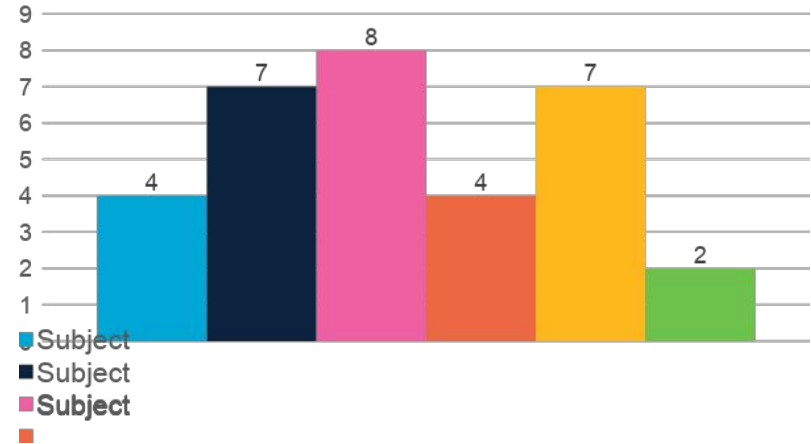
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Chart | 2x

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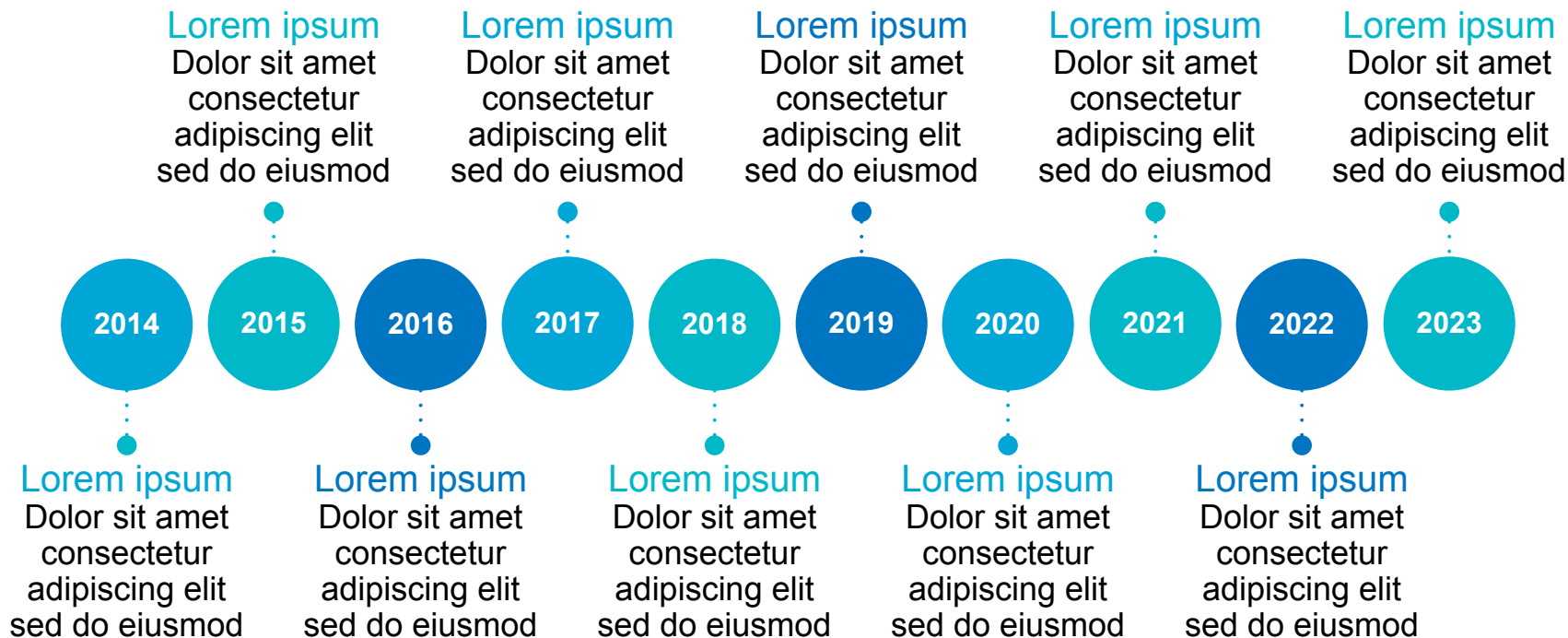
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Table | 2x

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Tijdslijn | 10x



Process | 5 steps



Step 1

Step 2

Step 3

Step 4

Step 5

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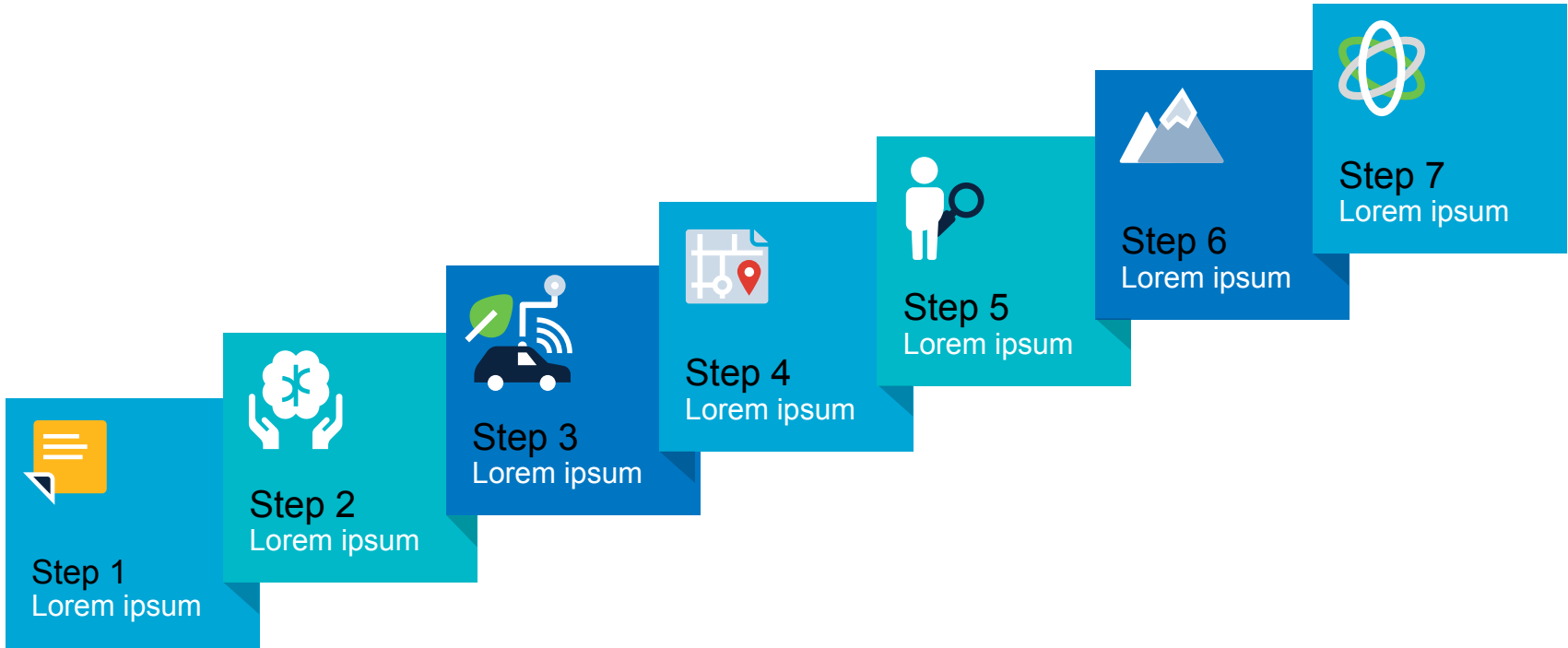
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Process | 7 steps



Circle diagram | 6x

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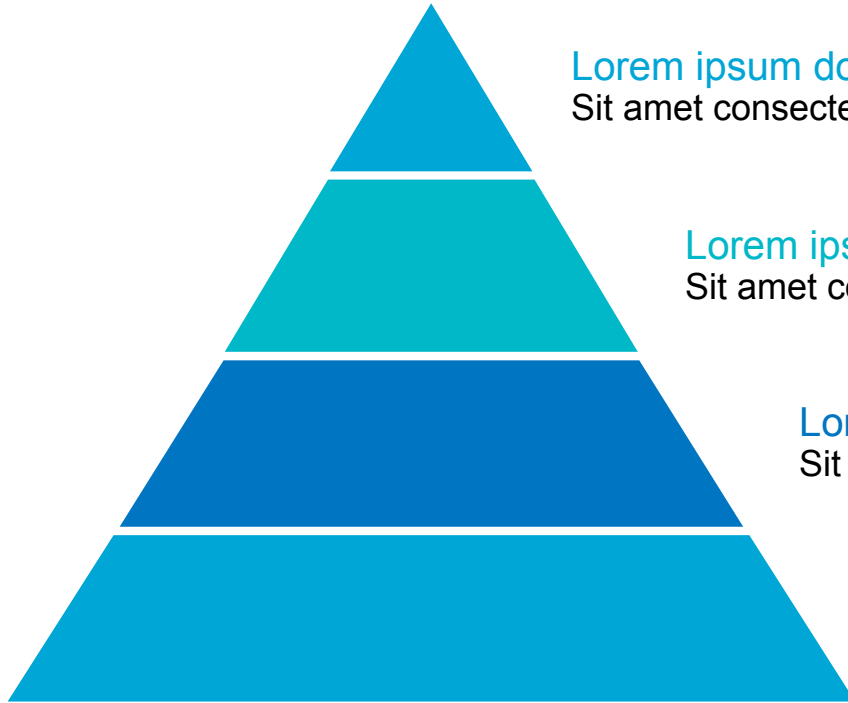


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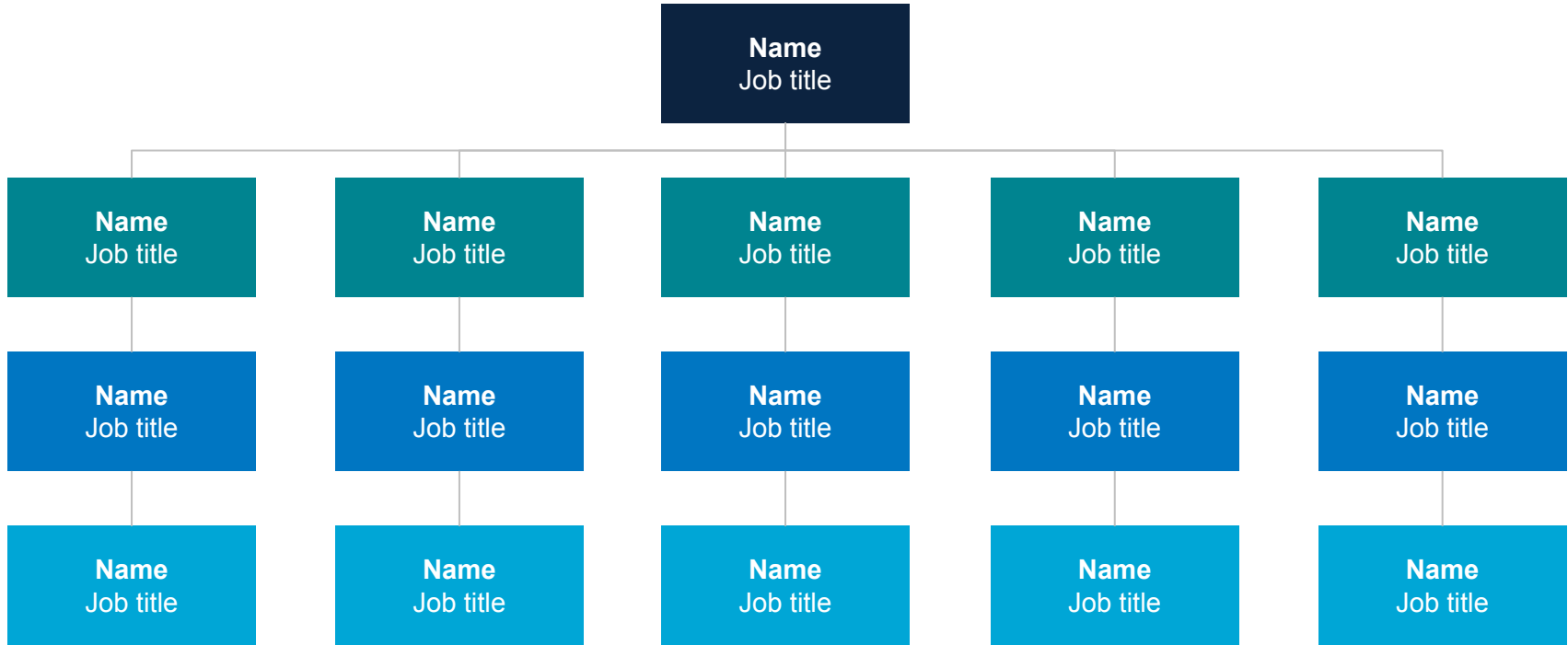
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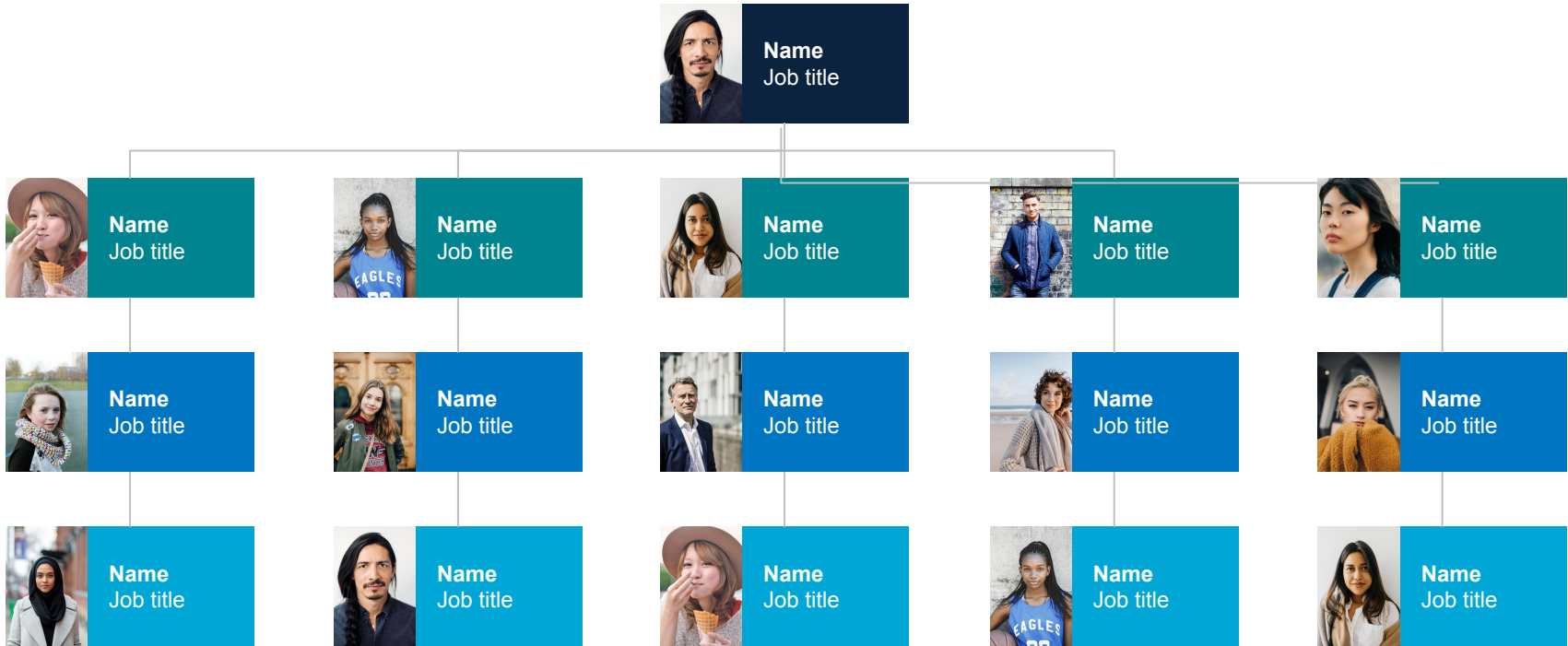
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Organogram



Organogram + photos



Notebook + text



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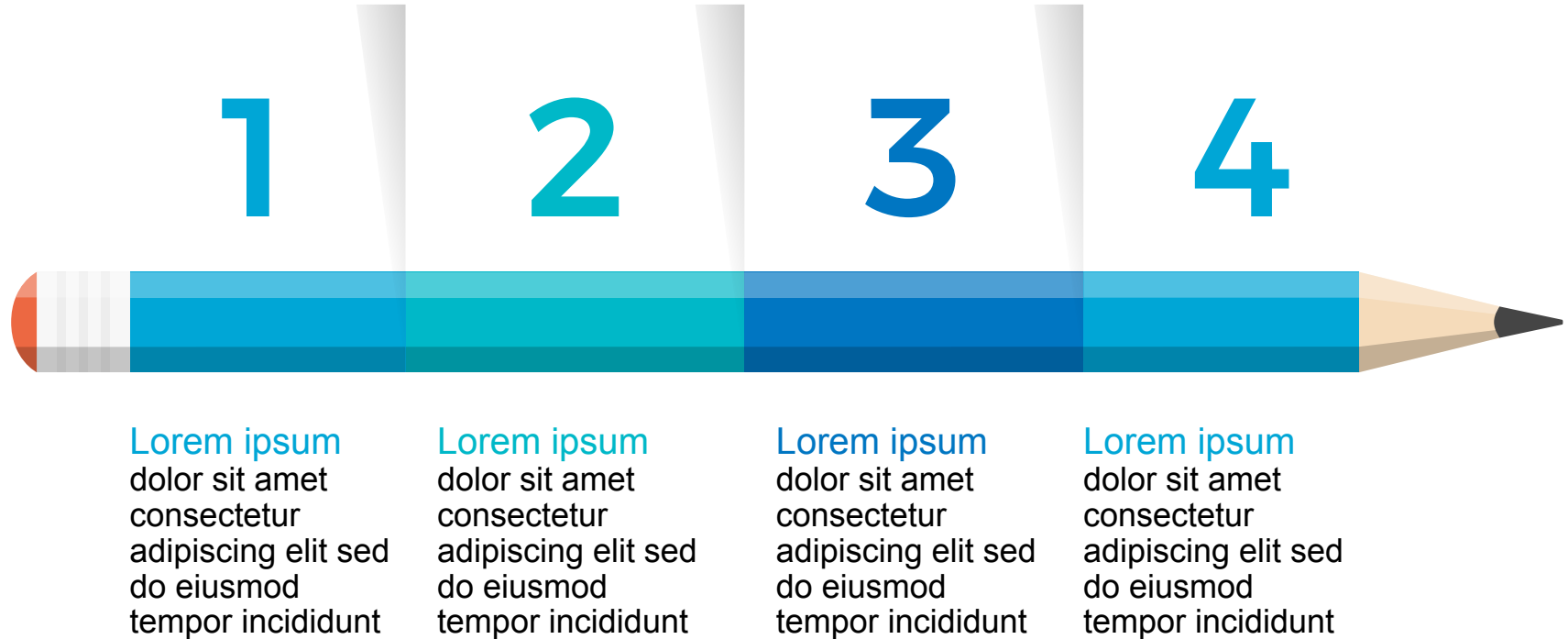
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Steps | 4x



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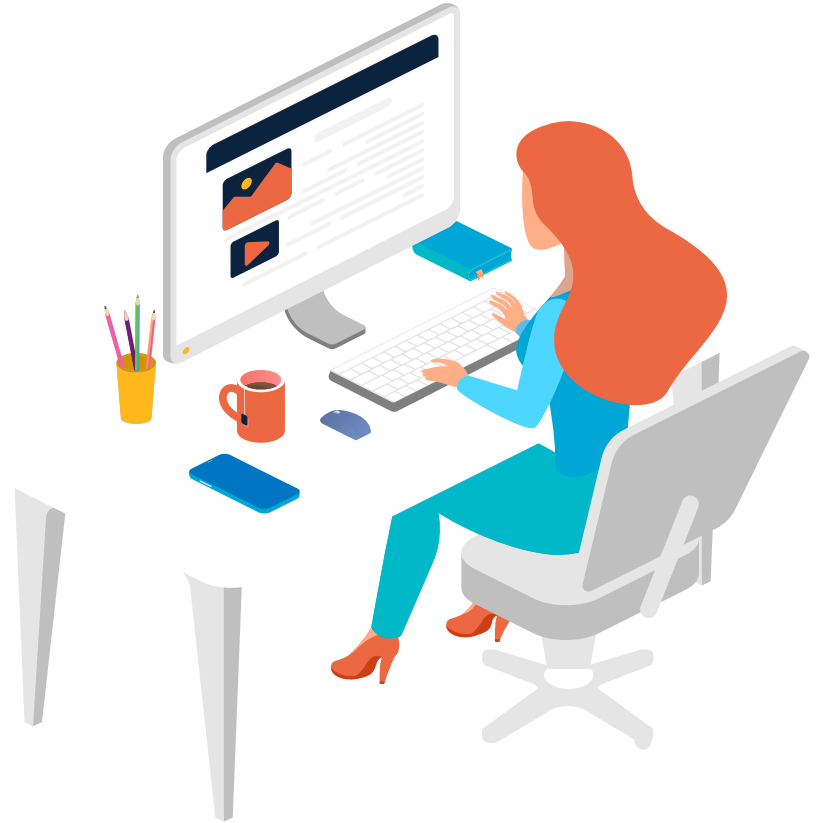
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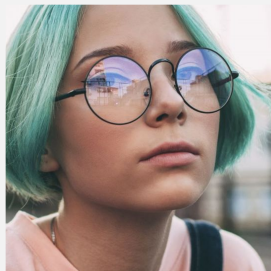
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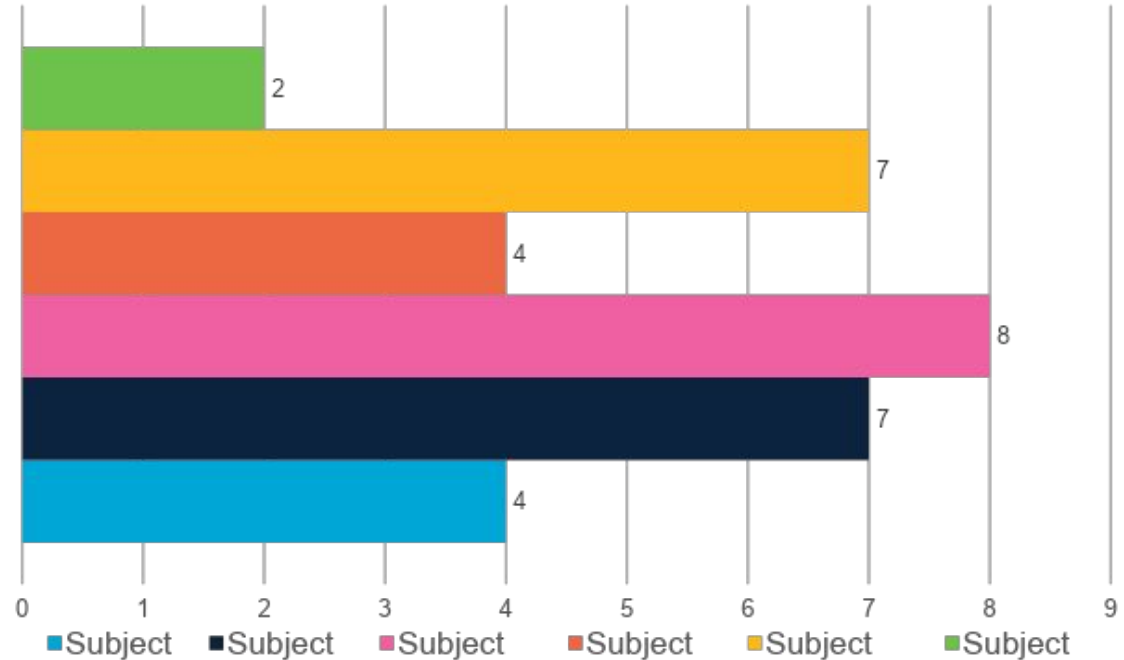
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Title slide

+ symbol #2

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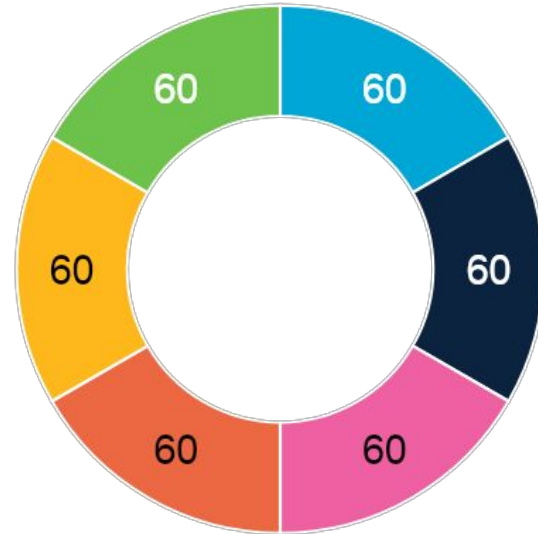
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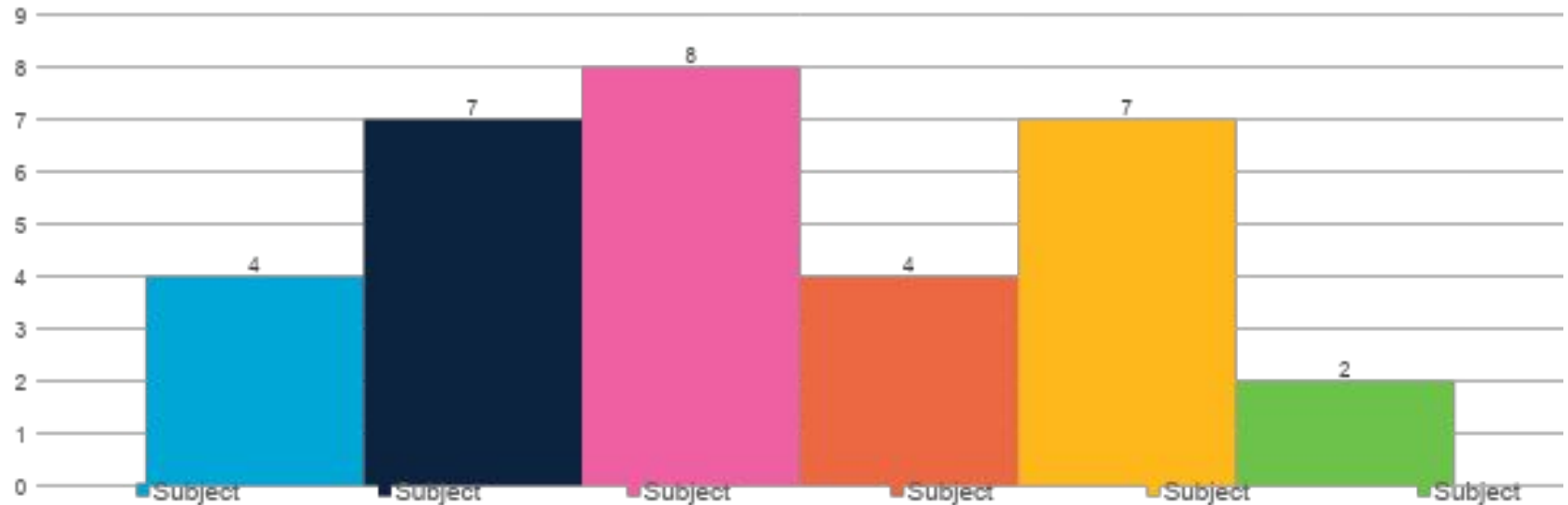
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Year	Subject	Subject	Subject
2019	40%	55%	40%
2020	7%	80%	7%
2021	20%	26%	20%
2022	69%	31%	69%
2023	82%	85%	82%
2024	89%	92%	89%

Table

Year	Subject	Subject	Subject	Subject
2019	40%	55%	40%	55%
2020	7%	80%	7%	80%
2021	20%	26%	20%	26%
2022	69%	31%	69%	31%
2023	82%	85%	82%	85%
2024	89%	92%	89%	92%

Title only