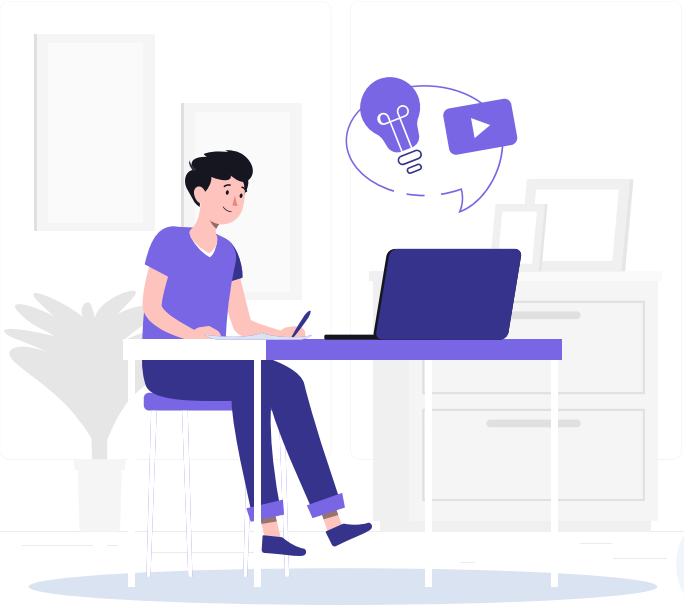
Occupancy Detection

Created and Presented
By
Cristina Sahoo



Problem Statement

Applications

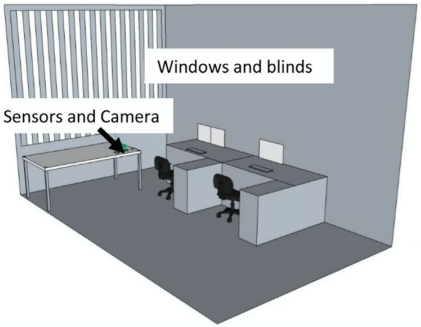
- Recent studies and measurements *[12-15]* report energy savings of 30% to 42% with accurate occupancy determination
- When occupancy data was used as an input for HVAC control algorithms, energy savings were as high as 80% *[16]*

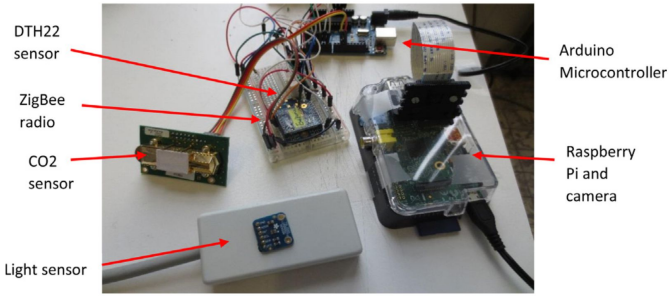
- A system that could accurately detect the presence of the occupants without using a camera is very interesting due to privacy concerns

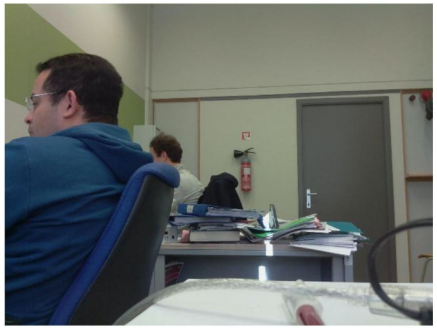
- Other applications for occupancy detection include security and determination of building occupant behaviors

Data Source and Collection

Occupancy Detection Dataset - UCI Machine Learning Repository







Data Cleaning

Data Dictionary

Feature Name	Feature Description	Units of Measurement or Format
date	time the observation was recorded	year-month-day hour:minute:second
temperature	temperature recorded	Celsius
humidity	relative humidity recorded	%
light	light recorded at time of observation	Lux
co2	CO2 measured at the time of observation	ppm, parts per million
humidity_ratio	derived quantity from temperature and relative humidity	kgwater-vapor/kg-air
occupancy	status of room occupancy	0 for not occupied, 1 for occupied status
weekday	indicates if the timestamp is weekday or weekend	1 for weekday, 0 for weekend

HOME

Monday
Progress 50%
Access

Tuesday
Progress 25%
Access

Wednesday
Progress 75%
Access

Thursday
Progress 10%
Access

Friday
Progress 90%
Access

Live Classes

Access

TASK 1 | MONDAY

Mercury is the closest planet to the Sun and the smallest one in the Solar System—it's only a bit larger than the Moon

TASK 1 | **TASK 2** | **TASK 3** | **TASK 4**

TASK 2 | MONDAY

Mars

Despite being red, it's a cold place

Mercury

It's the closest planet to the Sun

Saturn

It's the ringed one and a gas giant

Neptune

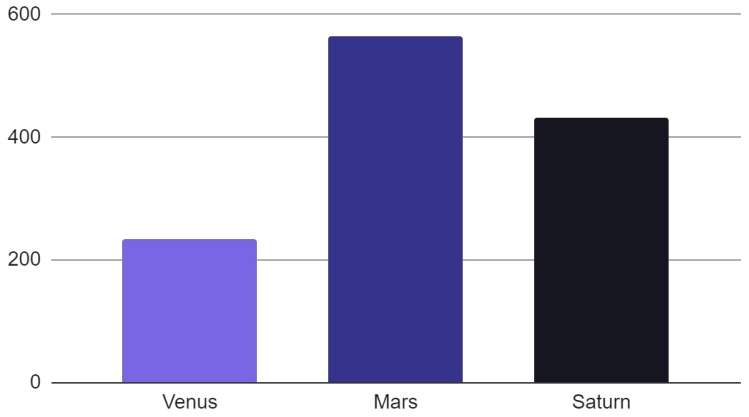
It's the farthest planet from the Sun

TASK 3 | MONDAY

Venus
Venus is the second planet from the Sun

Mars
Despite being red, Mars is a cold place

Jupiter
Jupiter is the biggest planet of them all



To modify this graph, click on it, follow the link, change the data and paste the resulting graph here, replacing this one

TASK 4 | MONDAY

01

Mercury is the smallest planet

The Moon is a natural satellite

02

03

Mars is actually a cold place

Jupiter is the biggest planet of them all

04

TASK 1 | TUESDAY

Mars

Despite being red, Mars is actually a cold place

Jupiter

It’s a gas giant and the biggest planet

Saturn

It’s composed mostly of hydrogen and helium

TASK 2 | TUESDAY

Goal 1

Mercury is the closest planet to the Sun

Goal 2

Despite being red, Mars is a cold place

Goal 3

Venus is the second planet from the Sun

Goal 4

Jupiter is the biggest planet of them all

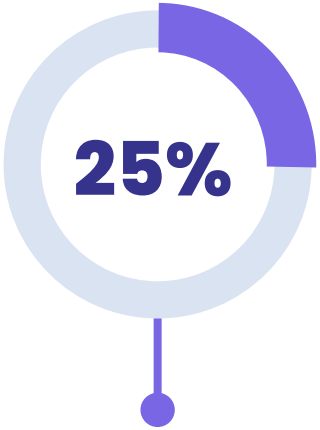
A PICTURE ALWAYS REINFORCES THE CONCEPT

Images reveal large amounts of data, so remember: use an image instead of a long text

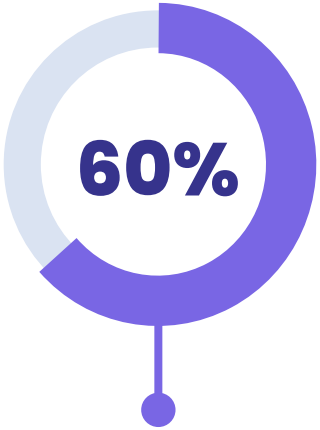
TASK 1 | TASK 2 | TASK 3 | TASK 4

Mon Tue Wed Thu Fri

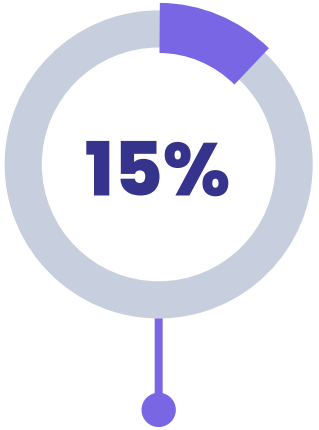
TASK 4 | TUESDAY



Saturn is composed of hydrogen and helium



Mercury is the closest planet to the Sun



Jupiter is the biggest planet of them all

TASK 1 | WEDNESDAY

Priorities

- Jupiter is the biggest planet of them all
- Despite being red, Mars is a cold place
- Mercury is the closest planet to the Sun
- Venus is the second planet from the Sun

Goals

- Neptune is the farthest planet from the Sun
- Saturn is a gas giant and has several rings
- Earth is the planet where we all live on
- Ceres is located in the main asteroid belt

TASK 2 | WEDNESDAY

2018
Mercury is the smallest planet

2019
Saturn is the ringed one

2020
Venus has a beautiful name

2021
Mars is a very cold place

TASK 3 | WEDNESDAY

Topic	Description	Done	Test Date
Mercury	Mercury is the smallest planet of them all	✓	01/05/2021
Neptune	Neptune is the farthest planet from the Sun	✗	01/12/2021
Saturn	Saturn is composed of hydrogen and helium	✗	01/19/2021
Jupiter	Jupiter is a gas giant and the biggest planet	✓	01/26/2021

TASK 4 | WEDNESDAY

Mercury

Mercury is the closest planet to the Sun and the smallest one in the Solar System

Venus

Venus has a beautiful name and is the second planet from the Sun. It’s terribly hot

Do you know what helps you make your point clear?
Lists like this one:

- They’re simple
- You can organize your ideas clearly
- You’ll never forget to buy milk!

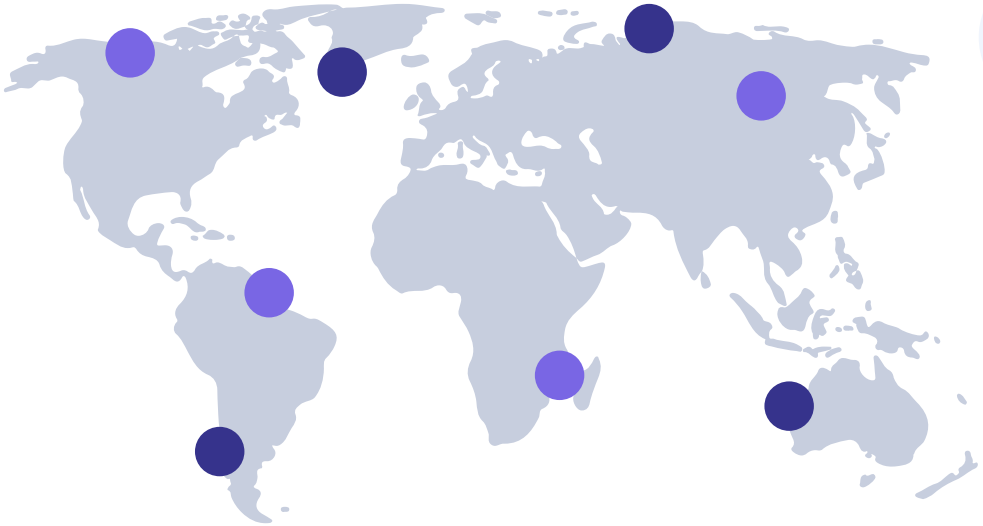
And the most important thing: the audience won’t miss the point of your presentation

TASK 1
THURSDAY

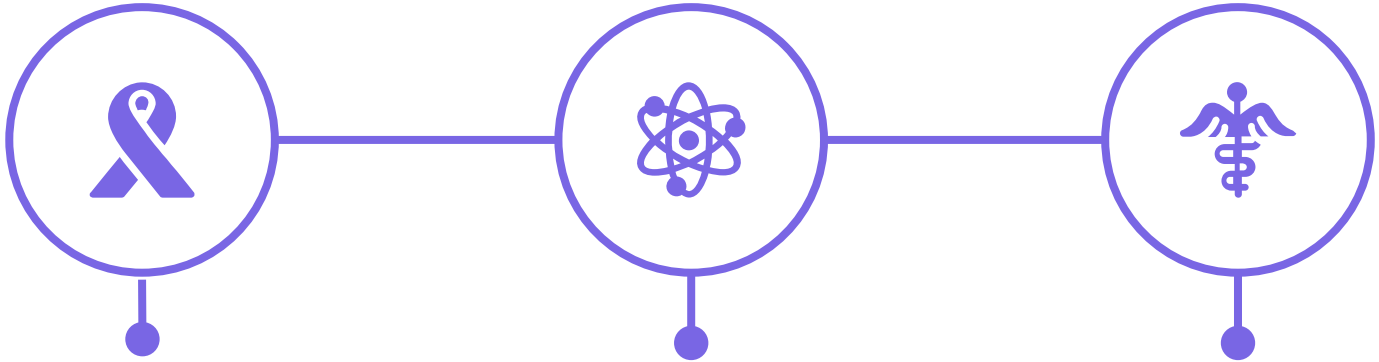
TASK 2 | THURSDAY

Where do our main clients come from?

- **Mars**
  Mars is actually a cold place
- **Venus**
  Venus has a beautiful name



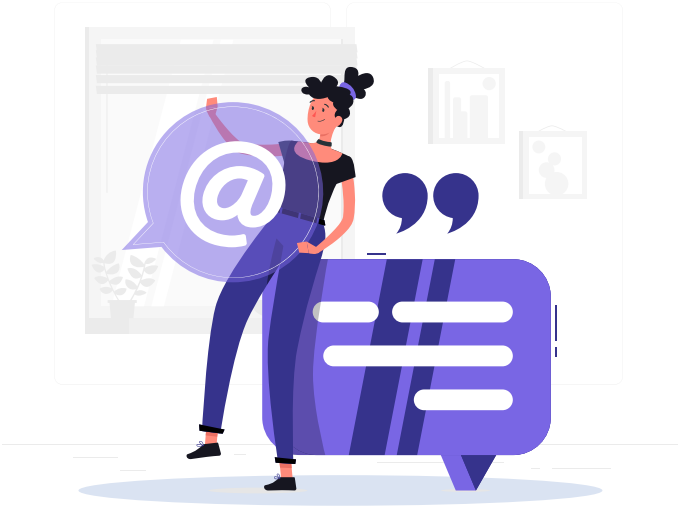
TASK 3 | THURSDAY



Mars
Despite being red, Mars is actually a cold place

Jupiter
Jupiter is a gas giant and the biggest planet

Saturn
Saturn is composed of hydrogen and helium



“This is a quote, words full of wisdom that someone important said and can make the reader get inspired.”

—SOMEONE FAMOUS

TASK 1 | TASK 2 | TASK 3 | TASK 4

Mon Tue Wed Thu Fri

TASK 1 | FRIDAY

Mercury
It's the closest planet to the Sun

Venus
It has a beautiful name, but it's hot

Mars
Despite being red, Mars is a cold place

Jupiter
It's the biggest planet of them all

Saturn
Saturn is the ringed one and a gas giant

Neptune
It's the farthest planet from the Sun

TASK 2 | FRIDAY

	Exercise 1	Exercise 2	Exercise 3
Mercury	Mercury is the smallest planet of them all	Ceres is in the main asteroid belt	Neptune is very far away from Earth
Mars	Venus is the second planet from the Sun	Jupiter is the biggest planet of them all	Earth is the planet where we live on

TASK 3 | FRIDAY

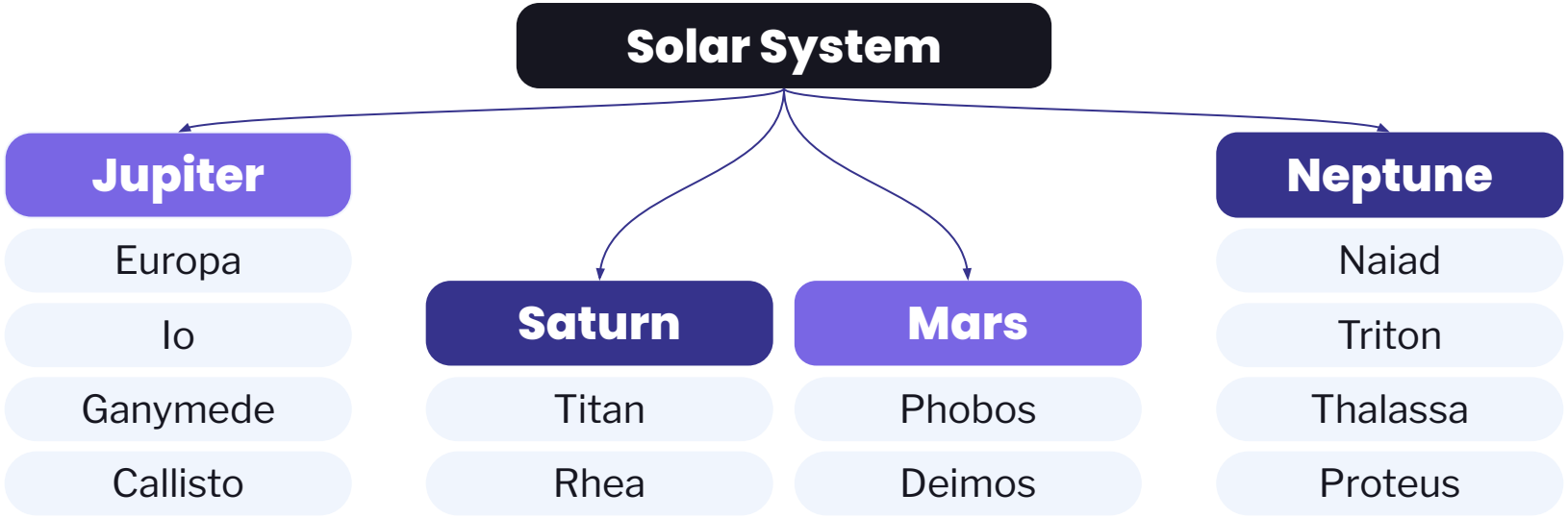
93%
Pass

Despite being red, Mars is actually a cold place

3-4
Months

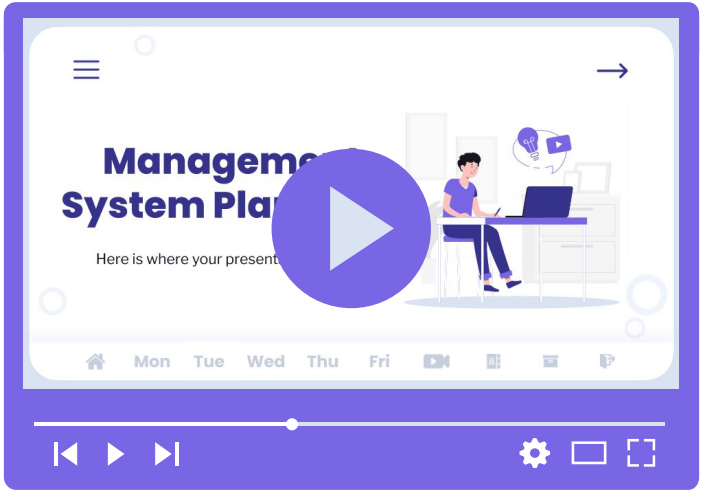
Venus has a very beautiful name, but it's terribly hot

TASK 4 | FRIDAY



LIVE CLASSES

Mars is full of iron oxide dust and, despite being red, Mars is actually a very cold place



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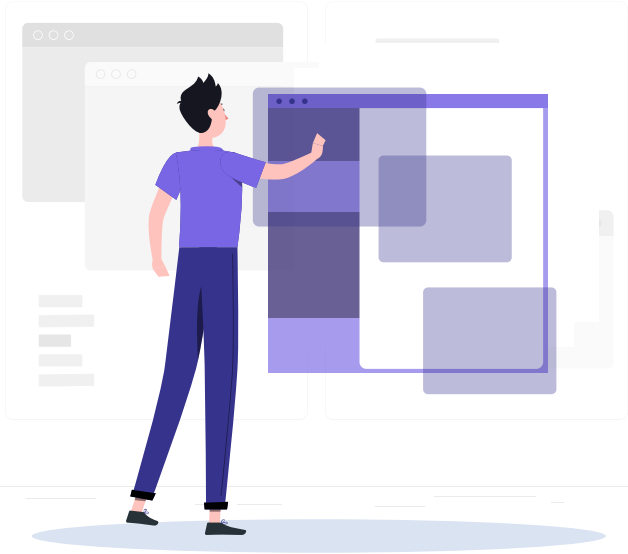

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Week 2

Week 3

Week 4

Week 5

Week 6

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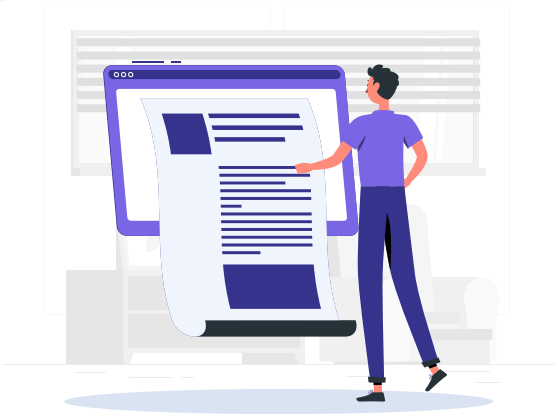

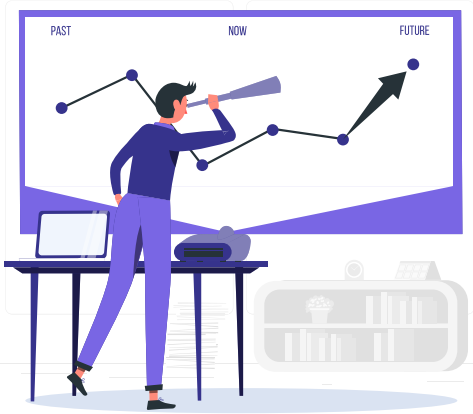

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(11) Accurate occupancy detection of an office room from light, temperature, humidity and CO2 measurements using statistical learning models. Luis M. Candanedo, VÃ©ronique Feldheim. Energy and Buildings. Volume 112, 15 January 2016, Pages 28-39.
(12) Calculate day in the past
(13) V.L.Erickson, M.Á.Carreira-Perpinán, A.E.Cerpa, OBSERVE:Occupancy-based system for efficient reduction of HVAC energy, in: Proceedings of the 10th International Conference on, IEEE, Information Processing in Sensor Networks (IPSN), Chicago, IL, 2011, pp. 258–269.
(14) V.L.Erickson, M.Á.Carreira-Perpinán, A.E.Cerpa,Occupancy modeling and prediction for building energy management, ACM Trans. Sensor Netw. (TOSN) 10 (3) (2014) 42.
(14) Dong B., Andrews B., (2009). Sensor-based occupancy behavioral pattern recognition for energy and comfort management in intelligent buildings. Proceedings of Building Simulation.
(15) J. Brooks, S. Goyal, R. Subramany, Y. Lin, T. Middelkoop, L. Arpan, L. Carloni, P. Barooah, An experimental investigation of occupancy-based energy-efficient control of commercial building indoor climate, in: Proceeding of the IEEE 53rd Annual Conference on, IEEE, Decision and Control (CDC), Los Angeles, CA, 2014, pp. 5680–5685.
(16) J. Brooks, S. Kumar, S. Goyal, R. Subramany, P. Barooah, Energy-efficient control of under-actuated HVAC zones in commercial buildings, Energy Build. 93 (2015) 160–168.

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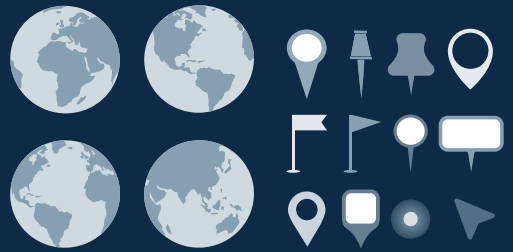

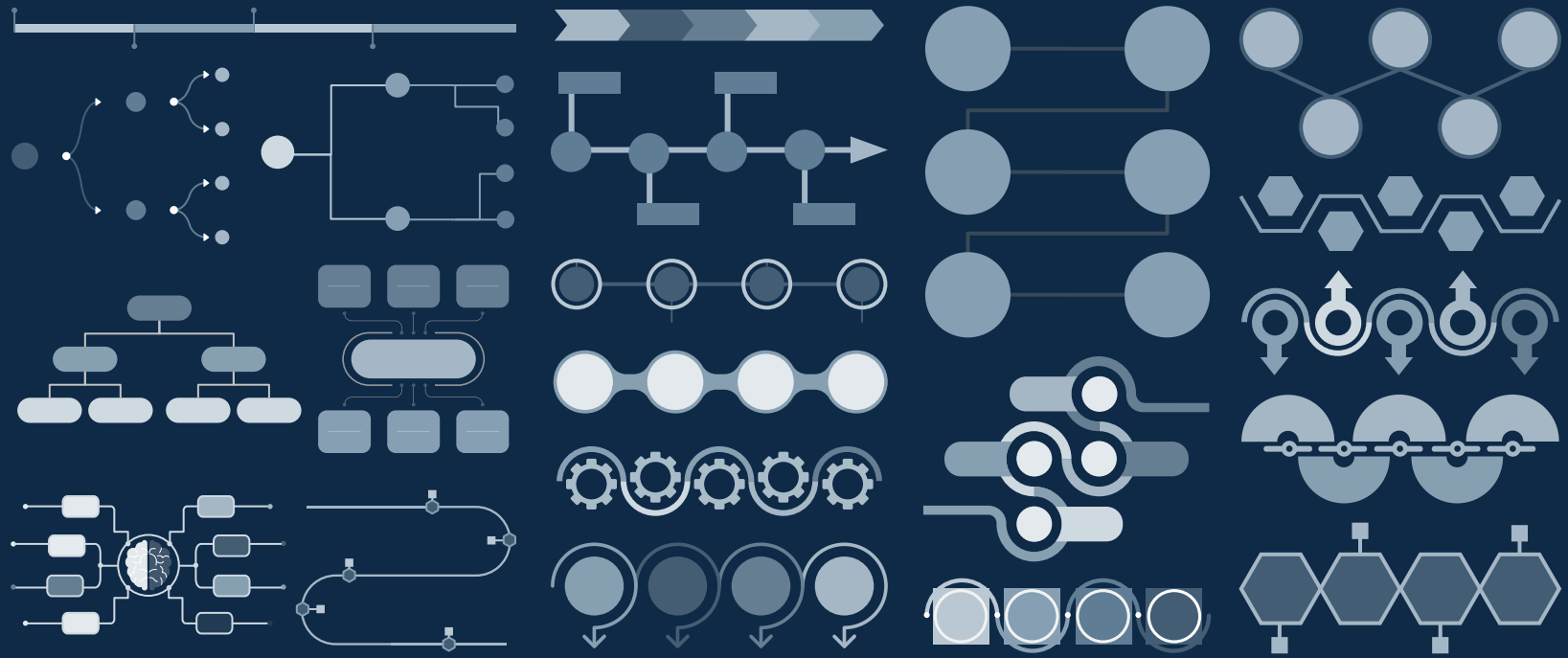

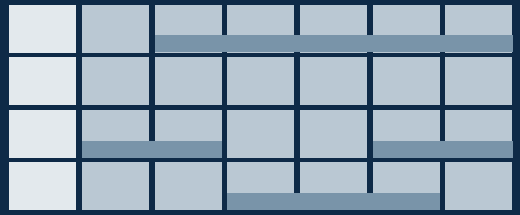

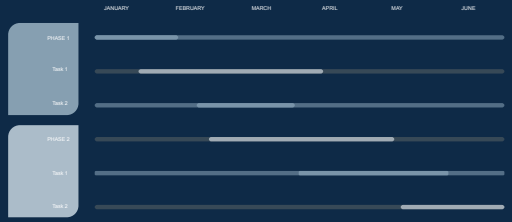
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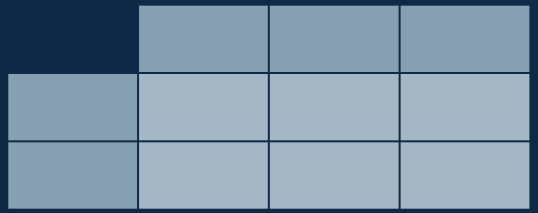
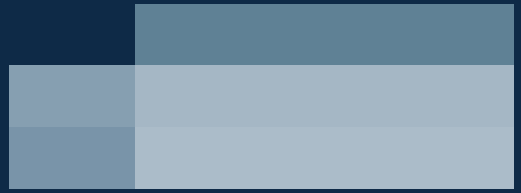
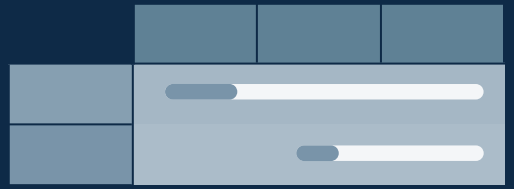
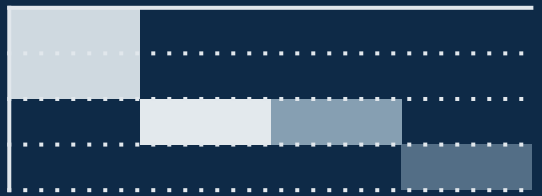
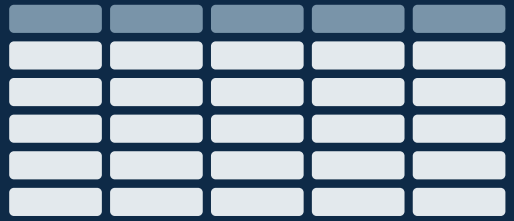
Task 2

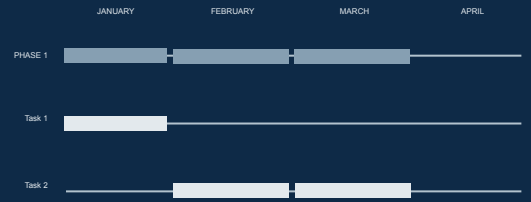








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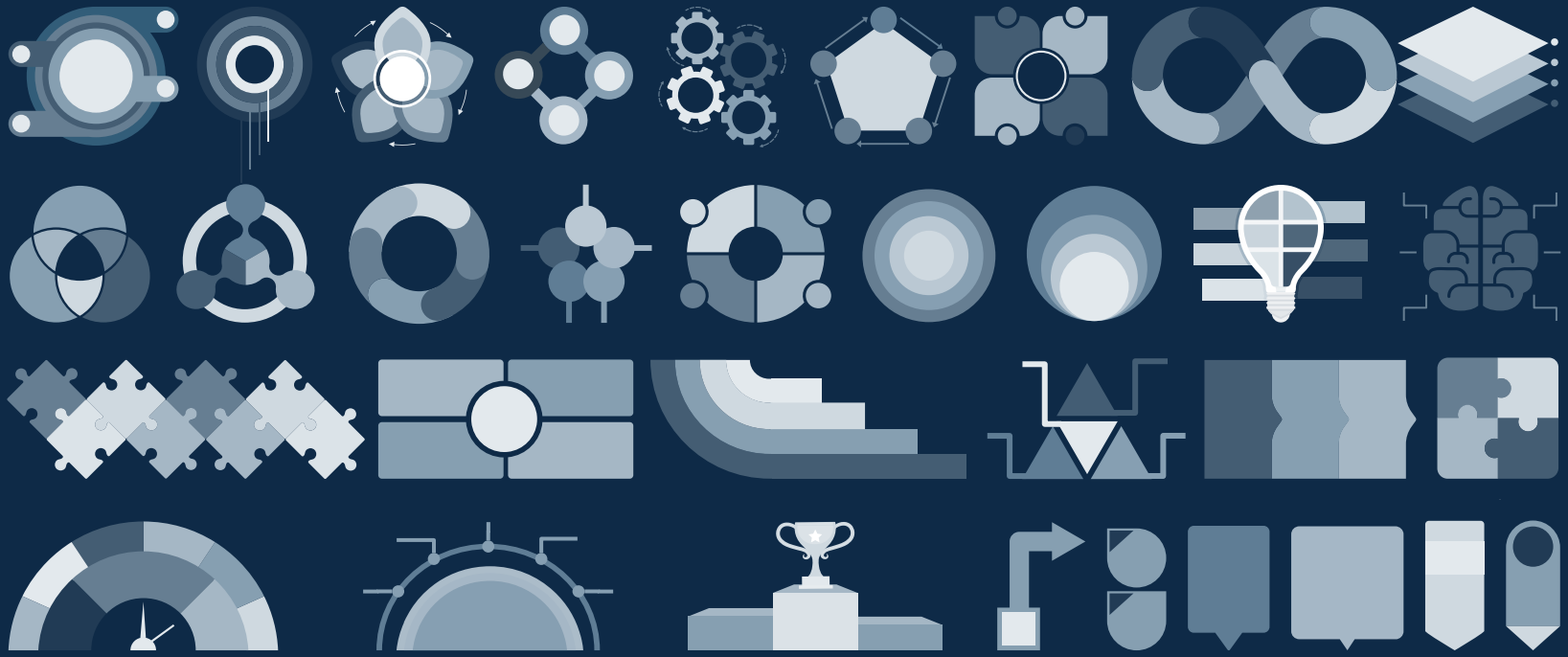

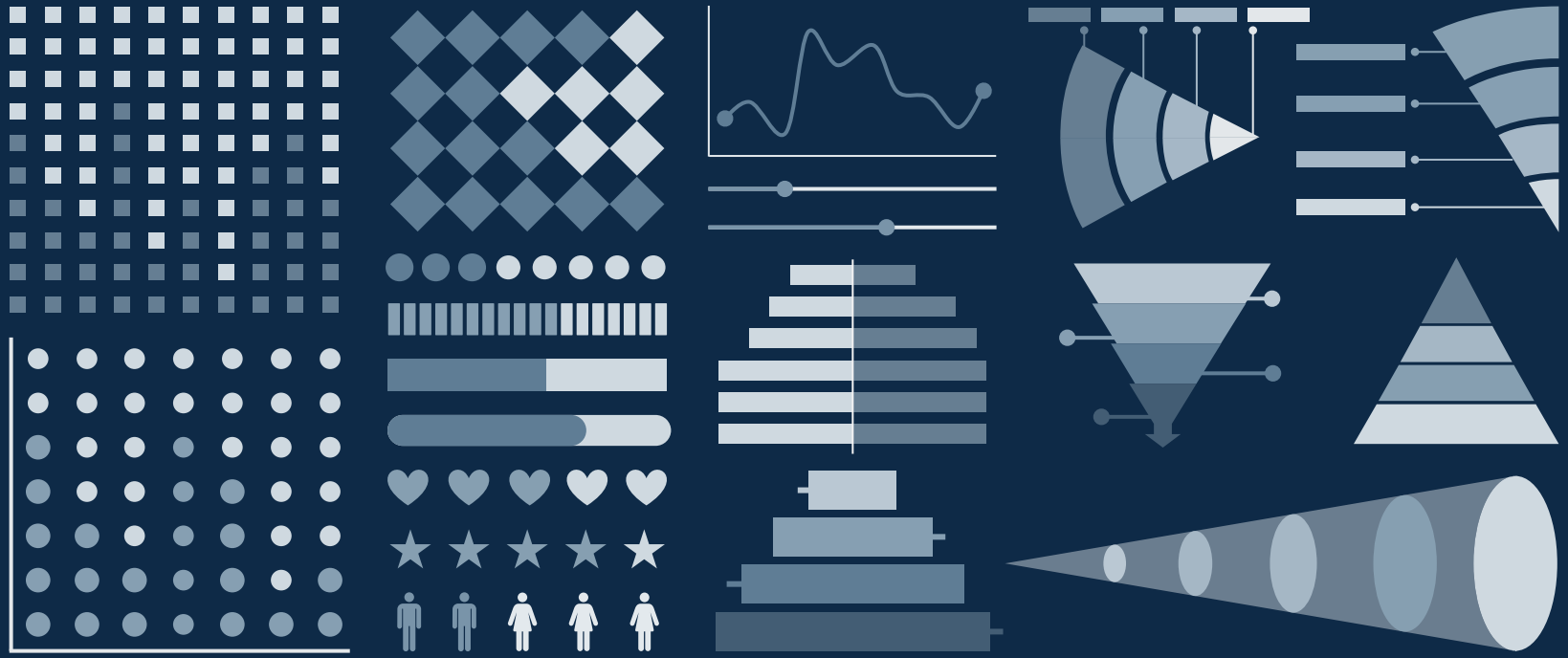

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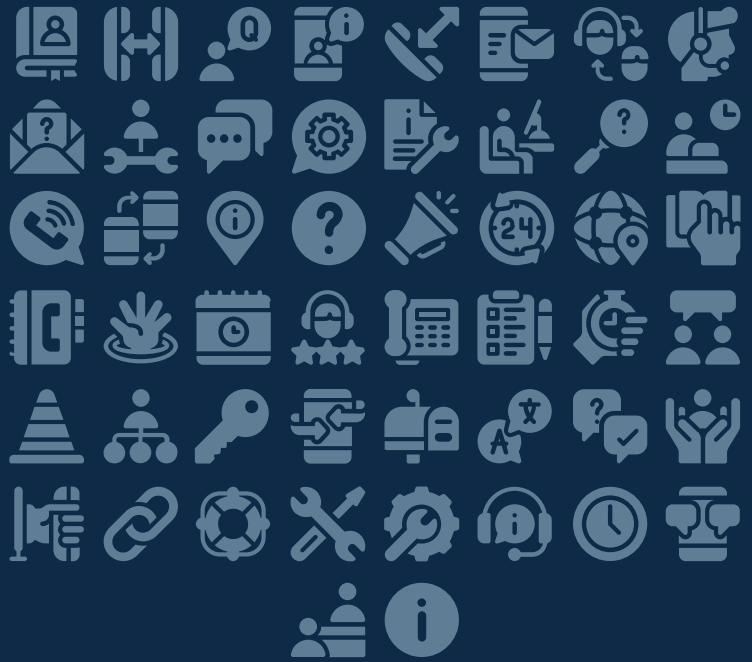

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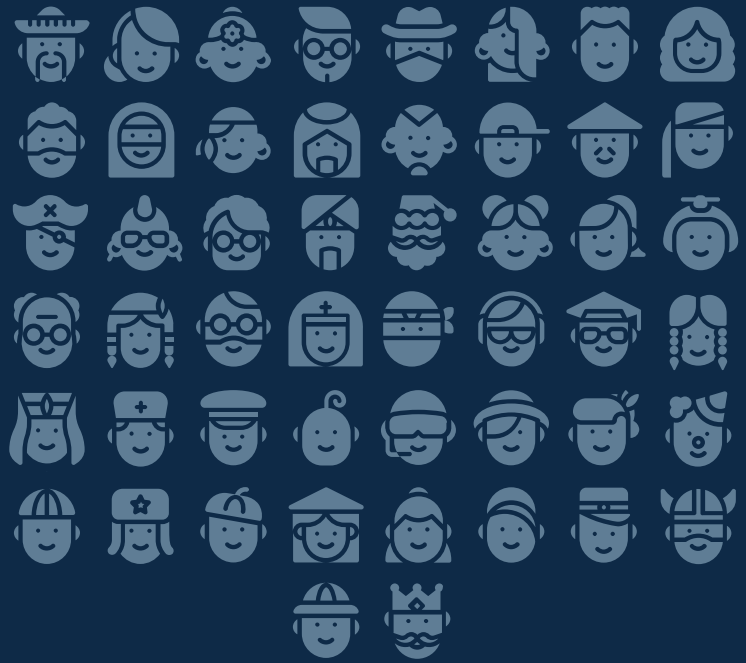

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