

# Technical Review

By GlowTech (Team F)

April 12, 2023

The background features a dark blue gradient with three prominent, wavy horizontal lines that transition from a lighter shade at the top to a darker shade at the bottom.

# Team's organisational structure

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- Designed to ensure efficient communication, collaboration and accountability
  - General Director: Tomás Cadete
  - Project Director: Tomás Prior
  - Product Director: Sara Carvalho
  - Quality Director: Francisco Riesenberger
  - Information and Documentation Director: Maria Pinheiro
  - Director of Automation: António Pan
  - Director of Energy: José Luís Monteiro
  - Director of Telecommunications: Alexandre Mourão

# Team's organisational structure

## General Director

- Communicates with the Professors
- Responsible for defining the project goal
- Manages the “company”
- Ensures a good work environment and relationships between “employees”
- Must be present in every general team meeting and transmits relevant information to the Project Monitor

# Team's organisational structure

## Project Director

- Plans and controls the development and execution of the product
- Defines tasks to be given to the Specialty Teams
- Adjusts the project schedule
- Reports to the General Director about problems related to the management of the team that may appear
- Communicates with the Product Director about technical and financial aspects of the product
- Interacts with the Quality Director to discuss the performance of the Specialty Teams

# Team's organisational structure

## Product Director

- In charge of the product's design, specifications and requirements
- Manages the budget for the project
- Decides the most economically viable options regarding the product's components
- Responsible for elaborating the product's data sheet
- Presents the product to potential clients

# Team's organisational structure

## Quality Director

- Defines the quality management model and the operating rules
- Defines how the information and documentation system must be organised
- Decides on the internal product quality requirements and evaluates the services provided by each collaborator (peer evaluation)
- Interacts with clients in order to infer the quality of the provided services

# **Team's organisational structure**

## **Information and Documentation Director**

- Manages the internal communication network
- Organises the team's reports and the scheduling utilities for the project
- Defines the documentation templates
- Creates possible advertising material

# Team's organisational structure

## Director of Specialty

- Responsible for the product's technical characteristics and development for the said Specialty
- In charge of searching for components and technical solutions for the product, considering their price and functionalities
- Takes part in the testing and approval of the product in its various design and development stages

# System requirements

# System requirements

## List of system requirements for LuSiTa identified by the team

1. System will implement colour-changing functionality: The lamp will change its colour based on the current price of electricity.
2. System will provide data display: The lamp will have a display that shows data about electricity prices, pricing schedules and lamp function modes.
3. System can adjust brightness: The lamp should have adjustable brightness settings that allow users to customise the level of illumination.
4. Compatibility: The lamp should be designed to work with standard electrical outlets.
5. Energy Efficiency: The lamp should use low-power LED technology to reduce energy consumption.

# System requirements

## List of system requirements for LuSiTa identified by the team

6. Wireless Connectivity: The lamp should be able to receive data and be configured wirelessly.
7. Automated Scheduling: The lamp should have an automated scheduling feature, allowing users to set it to turn on and off at specific times.
8. Low Maintenance: The lamp should be designed for low maintenance, with minimal cleaning and maintenance required to keep it working properly.
9. Intuitive User Interface: The lamp should have an intuitive user interface that is easy to navigate and use, even for those with limited technical knowledge.
10. Connectable to a configurable database with information about the electricity cost with data from previous and future prices.

# **System requirements**

**List of system requirements for LuSiTa identified by the team**

11. Access point connectivity to configure the lamp's wifi with the support of a third-party app.
12. The lamp should be highly portable, lightweight and small.
13. A countdown timer to show the next update time.
14. The commercial price can not exceed 50 € (including profit).
15. Alert the user of low battery level.
16. The system should have different tariffs and configurable time schedules.

# System requirements

## List of system requirements for LuSiTa identified by the team

17. The lamp should be rechargeable. The process to recharge should be to simply connect a charger to the lamp.
18. The lamp shell should not be made out of any brittle material (glass, for example) that could be easily damaged in transport.
19. The lamp should have a simple, mechanical on-off switch.
20. User-defined thresholds: Allow users to set their own price thresholds for when the lamp should change color. This gives users more control over the lamp's response to electricity prices.
21. The lamp should have a mode that shows what sources the energy is coming from. Each energy source would have a colour associated with it.

# System requirements

## List of system requirements for LuSiTa identified by the team

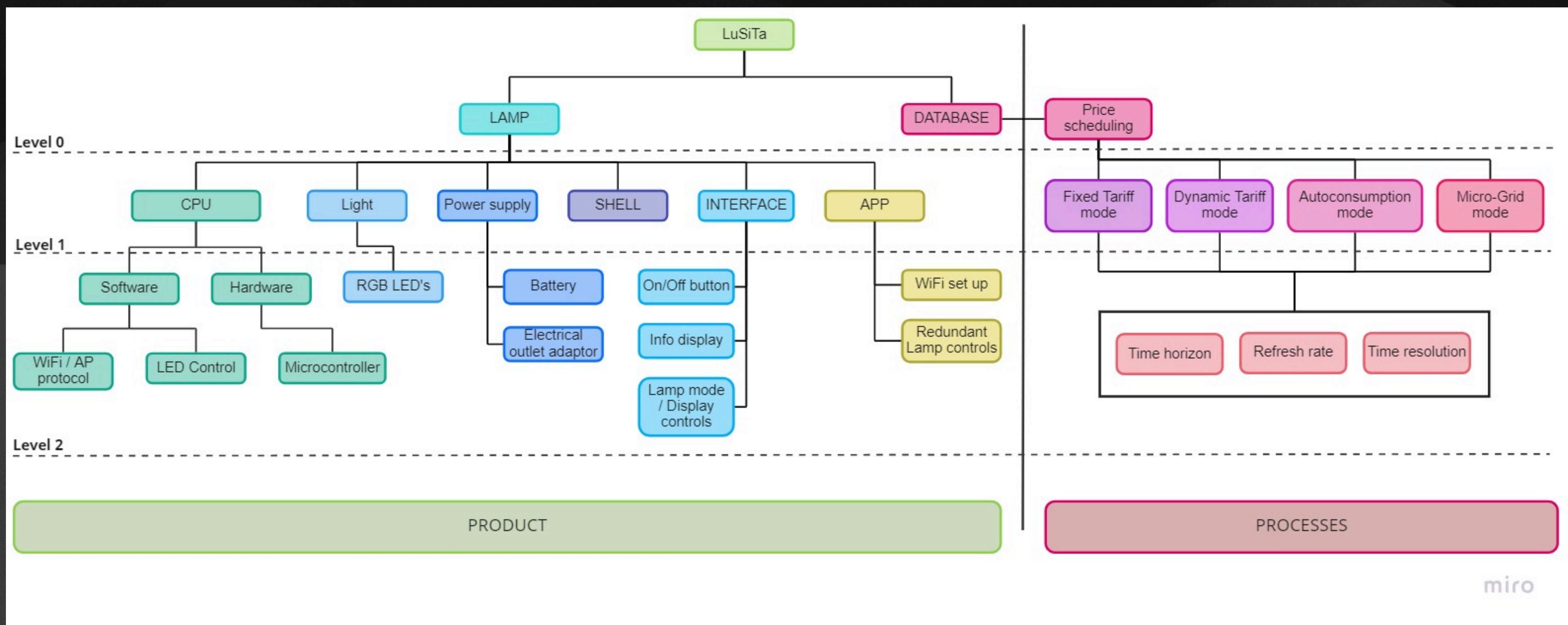
22. Customisable notifications: Allows users to set up custom notifications for electricity price changes when prices exceed a certain threshold.
23. The system could have different colour gradients. There are different colours of grid consumption in a day: peak time, standard consumption time, and lower-priced time (which is the best time for using high-consumption devices).
24. The database should store previous (or following ) energy prices so the user can check the actual values at will.
25. Depending on the mode (tariff) of the lamp, there will be a different refresh rate, different resolution and different prediction time span.
26. To provide mobility the lamp should function without being connected to an outlet for at least 6 hours.

The background features a dark blue gradient with three distinct wavy lines. The top wavy line is a medium shade of blue, while the bottom two are a darker shade. These waves create a sense of depth and motion.

# System's concept

# System's concept

## System Breakdown Structure



# Functional Architecture

## Modes of operation

- Two modes of operation:
  1. Manual mode: the user can control the lamp's colour and brightness settings manually, using the lamp's control panel.
  2. Automatic mode: the lamp adjusts its colour and brightness settings automatically based on real-time electricity prices, as well as ambient lighting conditions.

# Functional Architecture

## Components and interfaces

- Lamp Body: This is the main body of the lamp, which houses the LED lights and all the other components.
- Physical Interface: The display is located on the lamp body and allows the user to manually adjust the lamp's colour and brightness settings, while also displaying real-time electricity prices.
- Mobile Interface: The mobile interface for LuSiTa is designed to allow the user to control and monitor the lamp's behaviour from their smartphone.

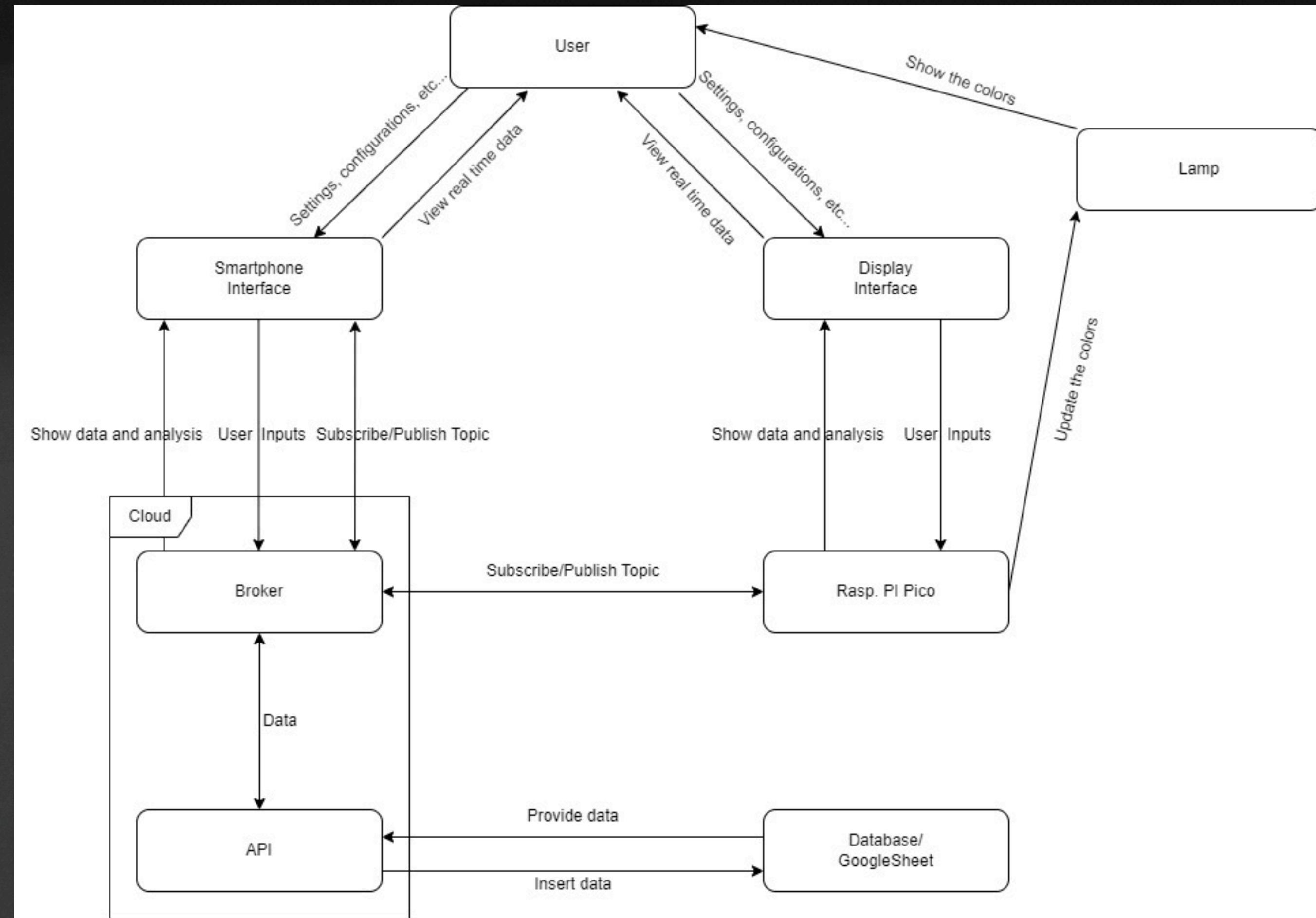
# Functional Architecture

## Components and interfaces

- Processor: The processor is the brain of the lamp, controlling the lamp's overall functionality and communication with other sub-components.
- LED interface: consists of the unit that contains the hardware responsible for the illumination.
- Database: stores information about electricity prices. This information is updated regularly to ensure the lamp displays the most up-to-date electricity prices and adjusts its behaviour accordingly.

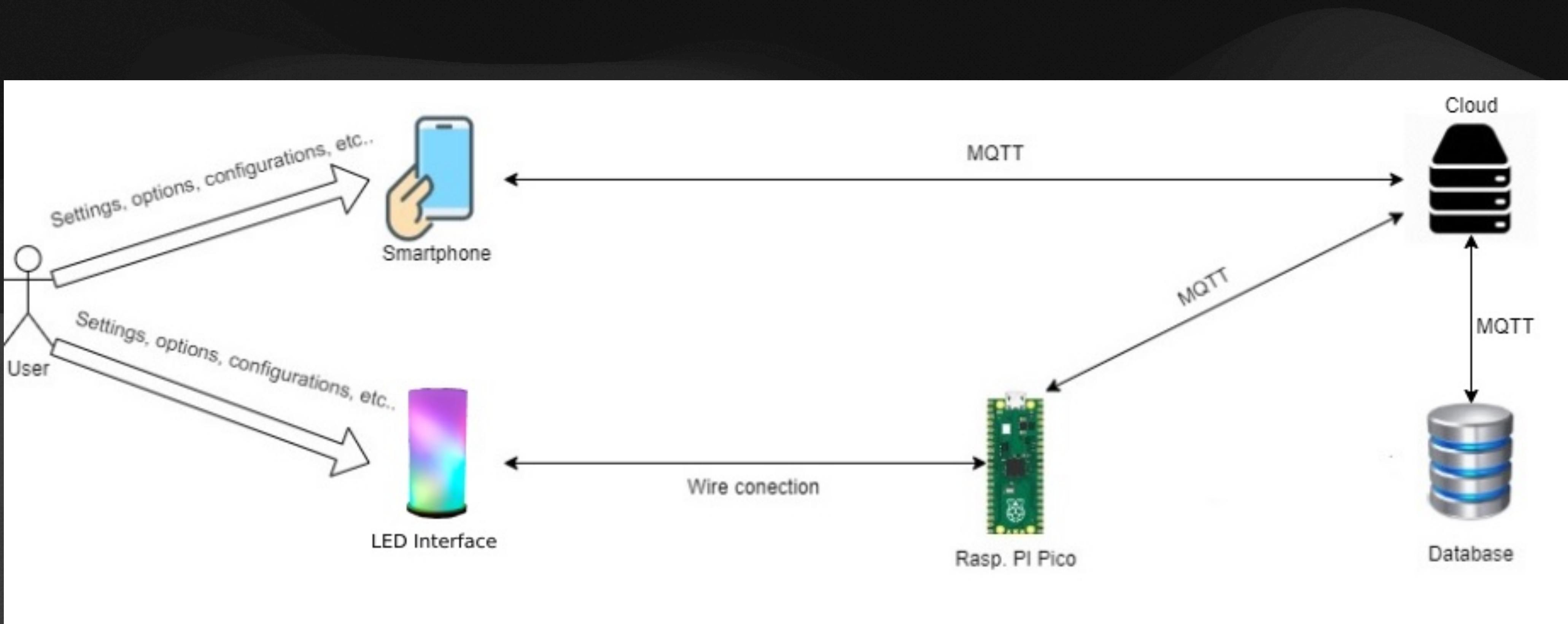
# Functional Architecture

## Functional Architecture Diagram



# Functional Architecture

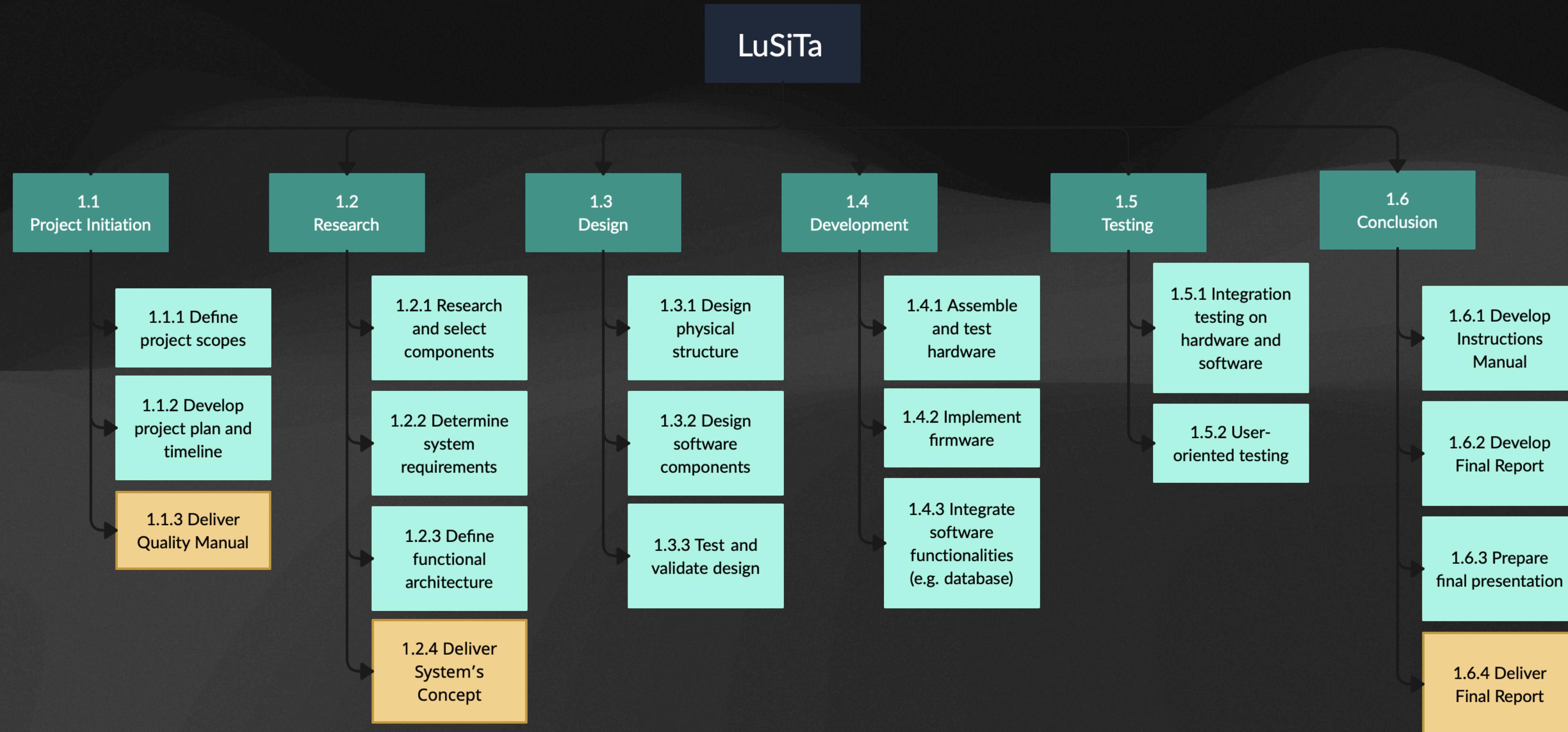
## System's Communications Diagram



# Work Breakdown Structure

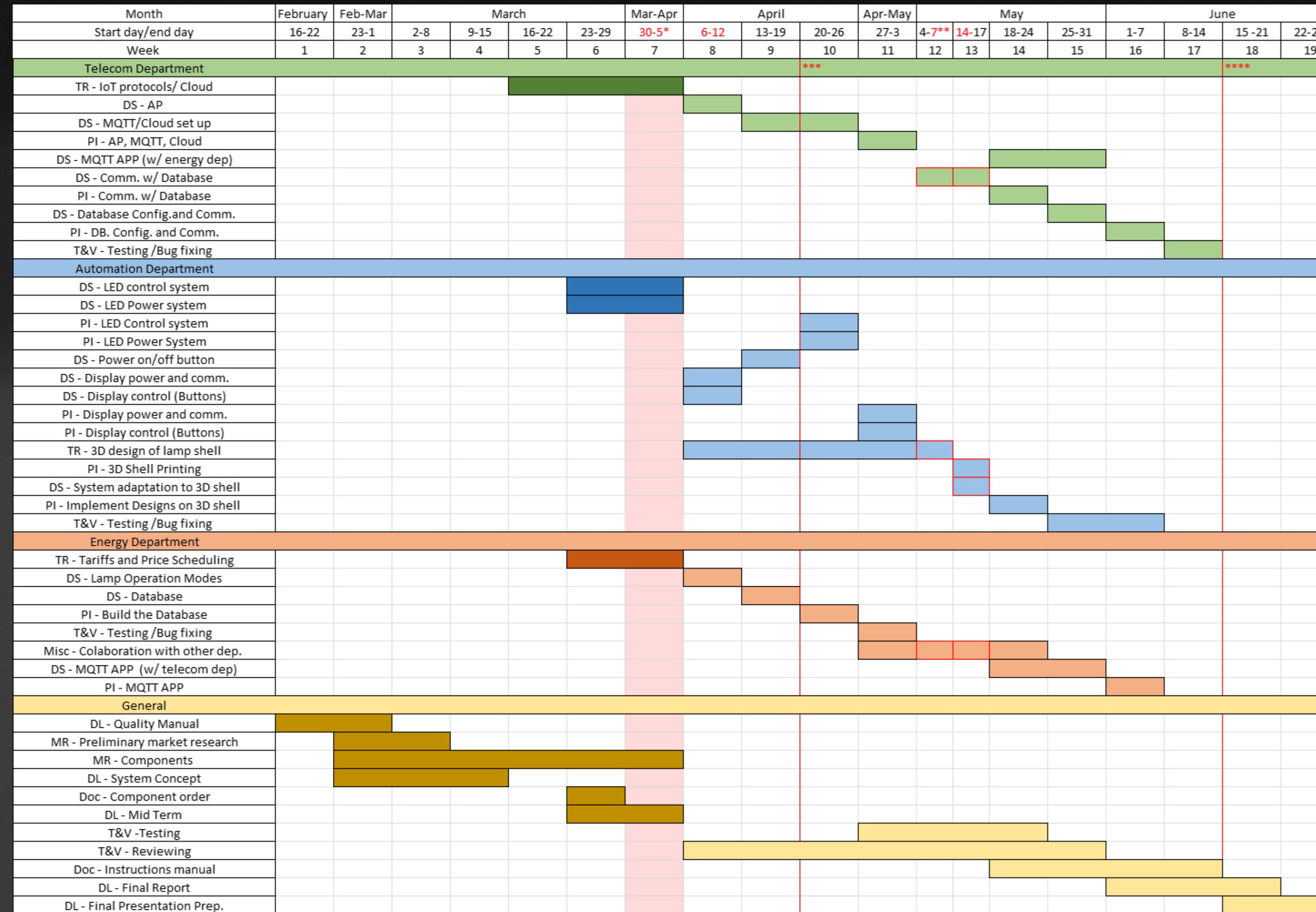
# Work Breakdown Structure

## WBS Diagram



# Work Breakdown Structure

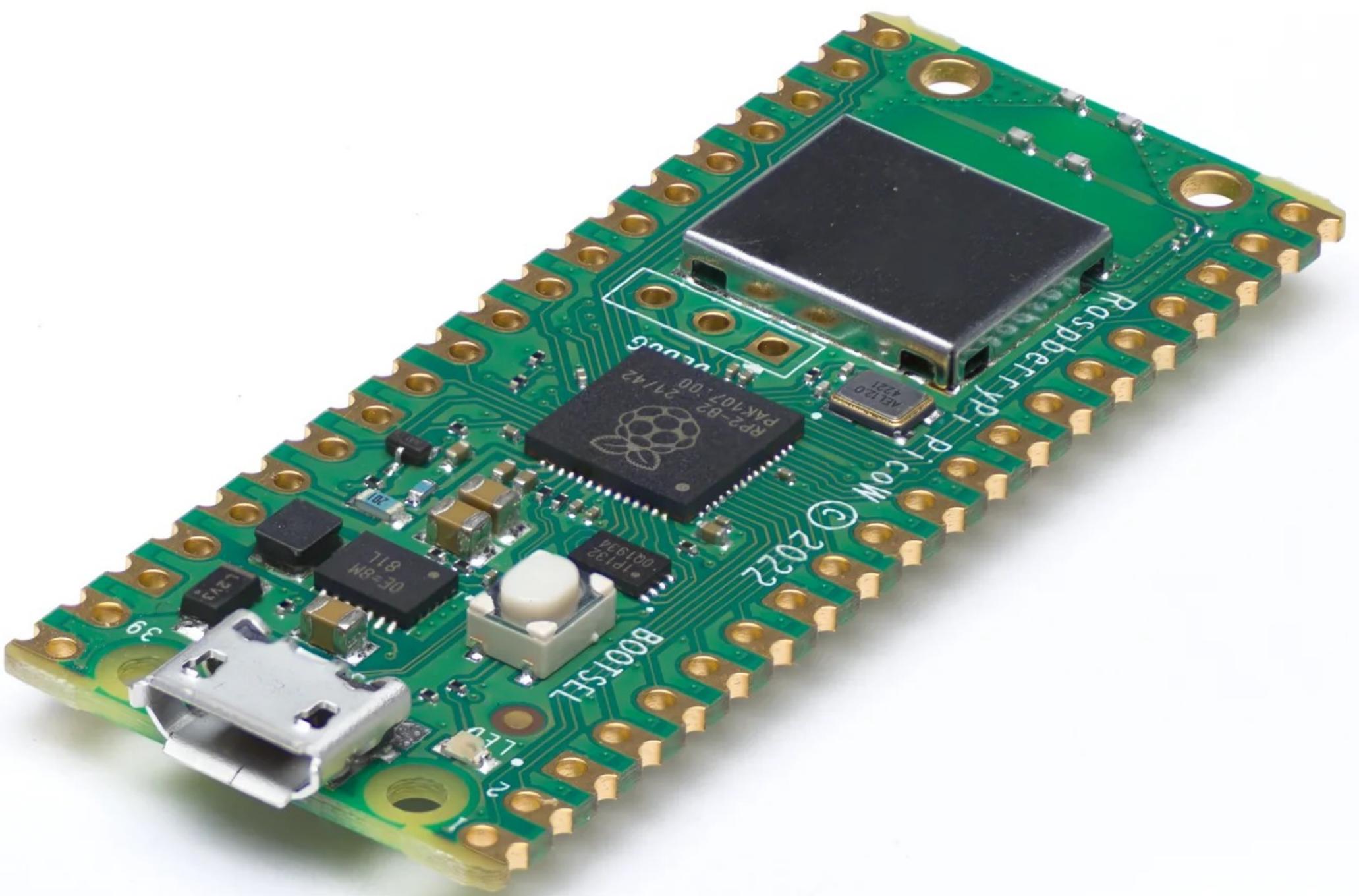
## Gantt chart for LuSiTa's development process



# Accounts Table summary

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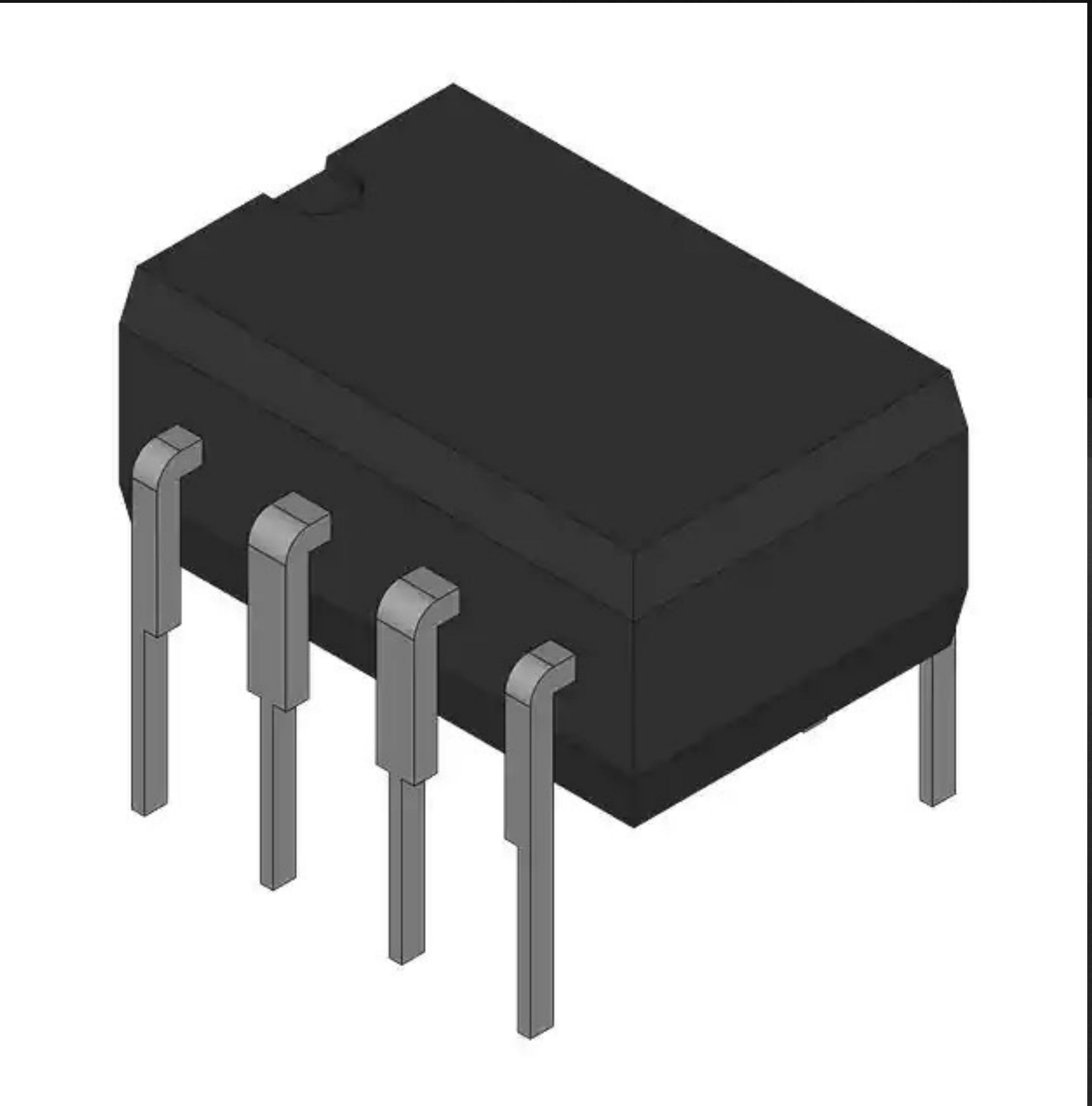
- Addressable RGB LED Strip
- (2 × ) Raspberry Pi Pico W
- (2 × ) Perforated Circuit Board
- Display OLED de 0,91"
- (2 × ) Power Bank



# Accounts Table

## Extra Components

- (2 × ) GPIO Pins
- (6 × ) Tactile Buttons
- On/Off Button
- (2 × ) TPS2034P (TH)
- (2 × ) AP22818AKCWT-7 (SMD)



# Protocols

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## Possible solutions for implementation

- **MQTT Only implementation:** consists of hosting an MQTT broker on the microprocessor and establishing the connection between the client, which uses the 3rd party app MQTT DASH, and the broker using an access point, hosted in the microprocessor.
- **HTTP only implementation:** consists of hosting an HTTP server of the microprocessor and similarly to the first possibility the client connects to it using a browser.
- **MQTT and HTTP implementation:** consists of hosting an HTTP server on the microprocessor and using an access point to establish a connection between the server and the user, while LuSiTa is not connected to WiFi. When the user connects to LuSiTa's access point, he will be presented with a captive portal where he can input the WiFi data.

# Broker

## AWS IoT Core

- Cloud platform provided by Amazon Web Services (AWS)
- Allows devices to connect securely to the cloud and interact with other devices and services
- Possibility of hosting an MQTT Broker that meets the used criteria

