Energy controller

Energy Controller is an advanced solution based on the Internet of Things (IOT) designed to monitor and optimize energy consumption within industrial companies both in the production chain and current consumption for charging electric cars. The core of this project is represented by a specially designed PCB with an ESP32 microcontroller on board, programmed in C++, which together with web and mobile clients create a highly sophisticated integrated energy monitoring system.

This innovative system focuses on measuring the current consumed by each individual at charging stations, providing stable alternating current power output at 220v - 16 or 32 amps, customizable to meet the specific needs of the company. Energy Controller's strategic approach aims to monitor and assign a consumption index to each company department, providing a detailed overview of energy consumption. This precious information allows you to optimize the entire production process, reducing the overall costs of the product sold.

Energy Controller is at the forefront of digital transformation in the industrial sector, offering an innovative approach to energy management. This solution not only helps to optimize production processes, but also to reduce environmental impact, promoting greater corporate sustainability.

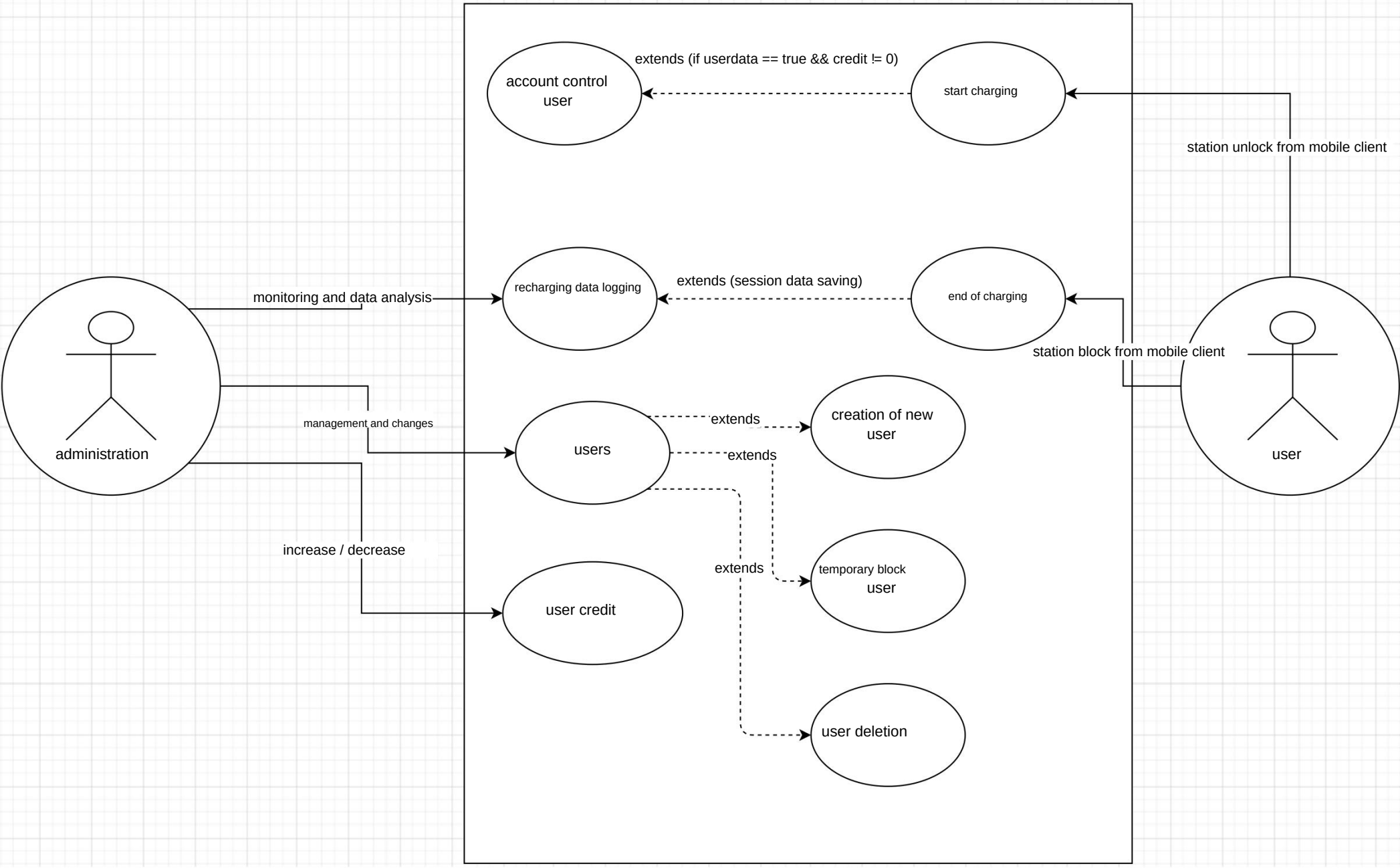
PCB

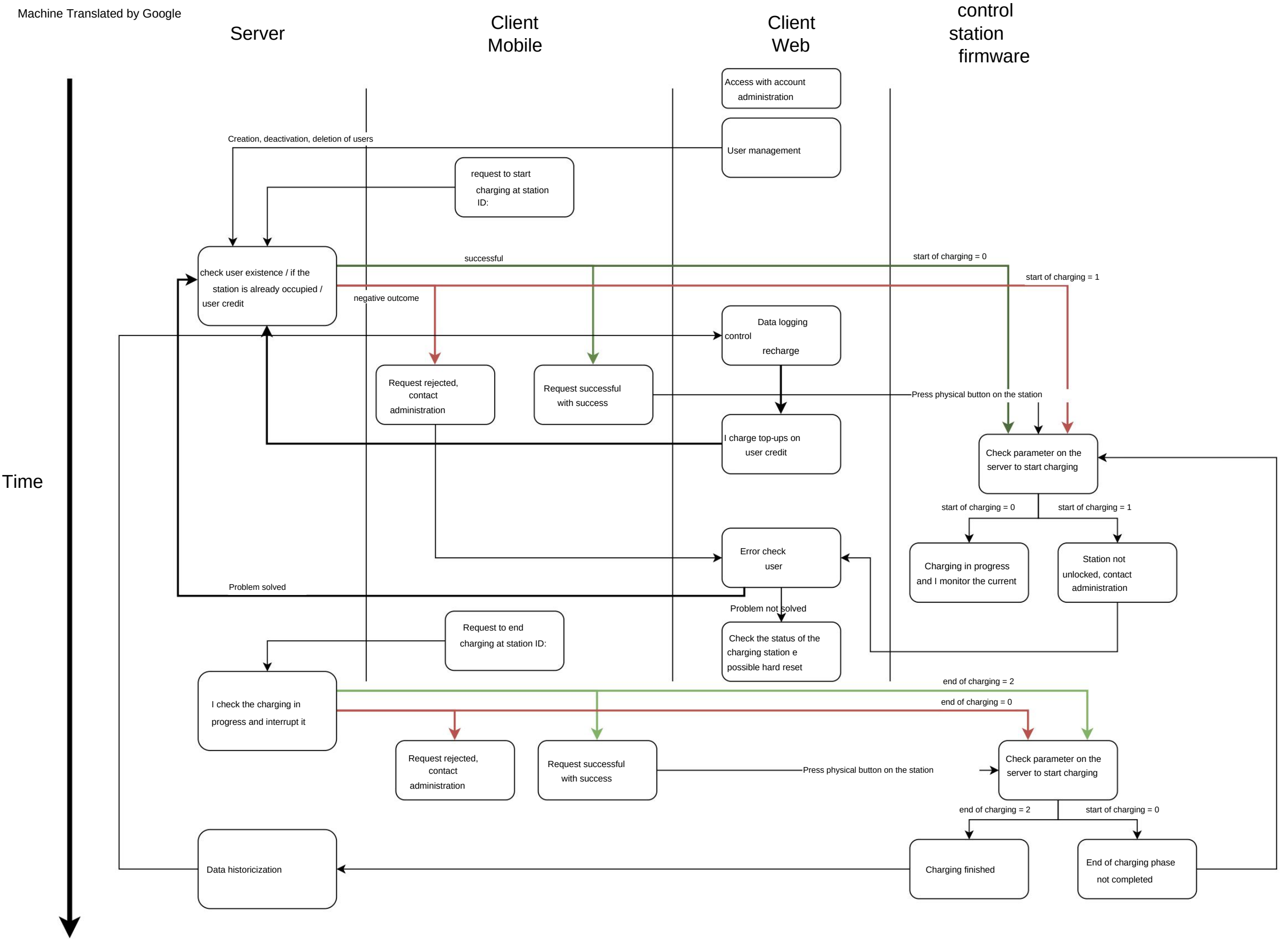
The Energy Controller PCB structure, with a size of 105mm x 100mm, has been carefully designed to ensure perfect integration into the dedicated housing. A distinctive element is the presence of a second PCB board, connected through an intelligent pinout, which houses all the components of the ESP32 microcontroller. This solution was adopted with the aim of effectively solving the interference problems that could occur on the ESP32 due to the 32A at 50Hz alternating current, thus eliminating possible continuous restarts and ensuring optimal operational stability.

The PCB dedicated to current monitoring is equipped with a Relay of considerable capacity, capable of managing currents up to 40A at 270V, playing a crucial role in controlling the release of the current when the column is inactive. The relay is activated by a 5V current with a low amperage, ensuring efficient power management. To precisely monitor the current, a 40A ACS712 sensor was implemented, capable of returning an analogue reading, subsequently converted digitally by the ESP.

The board also includes 4 outputs equipped with JST connectors, intended for two OLED monitors connected in I2C mode, an RGB LED and a button. Expanding the repertoire of

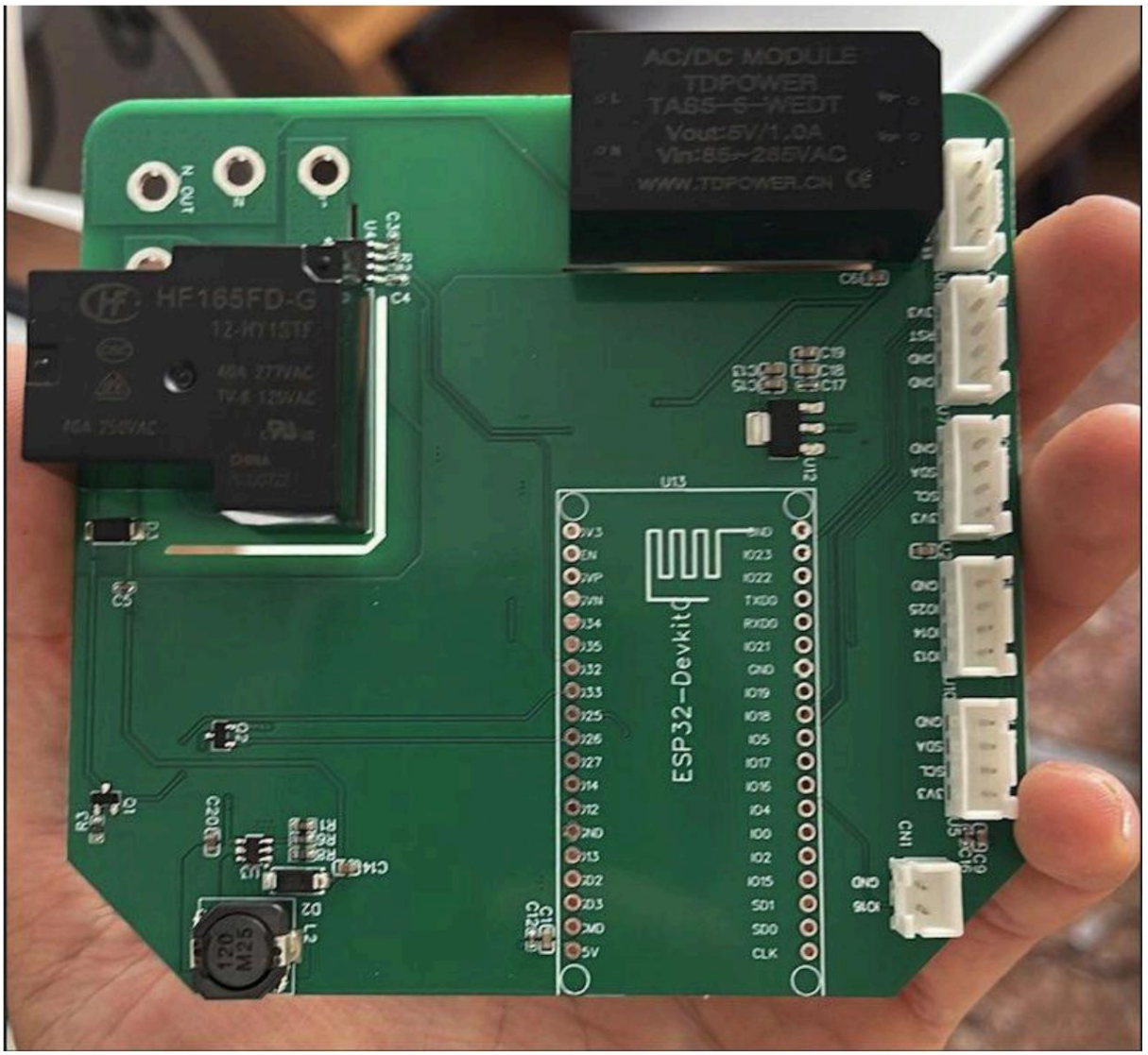
ENERGY_CONTROLLER USE CASES





sensors, a Dallas 18b20 temperature sensor has been included, which is critical for monitoring the internal conditions of the PCB housing, preventing potential risks related to excessive overheating, which could culminate in a potential fire risk.

The complex system is powered by a 220V alternating current input, managed by an AC/DC power supply with a 5V output and a maximum of 1 amp. This power configuration, in addition to ensuring a stable and efficient supply, proves to be more than adequate to support all the devices on the board, giving the Energy Controller system a solid and reliable operational basis.



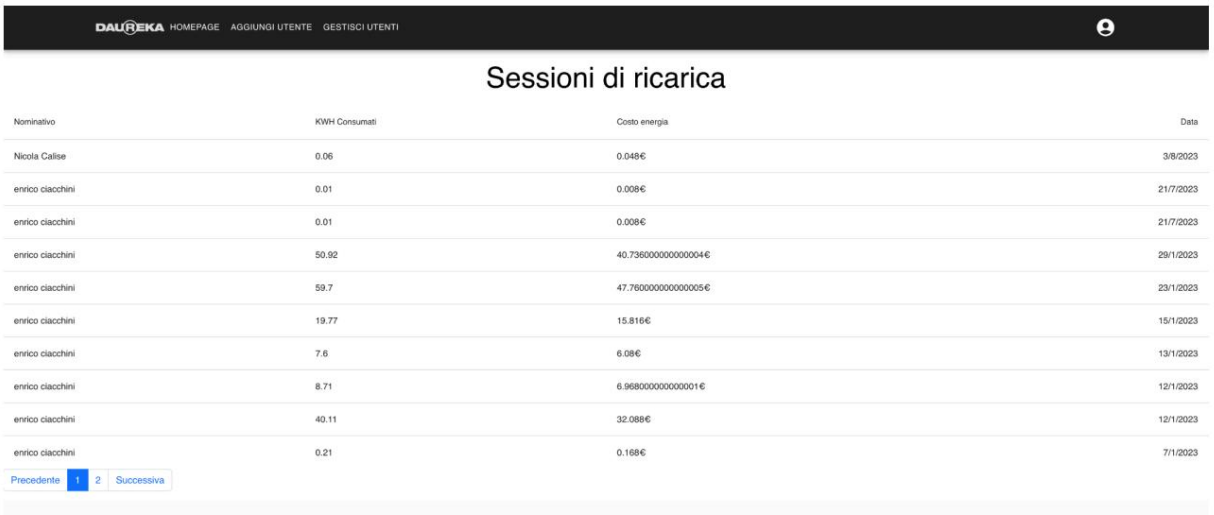
Web client

Within the Energy Controller ecosystem, let's focus on the web client,

an exclusive interface used by the company's administrative department. Access takes place through personalized credentials consisting of username and password, carefully provided by specialized technical personnel. This advanced web portal offers a complete overview of your company's charging activities, presenting key data through intuitive tables and graphs that allow you to analyze energy consumption by department and make strategic assessments.

The web client is not limited to merely viewing data; It also offers advanced user management features. The administrative department has total control over the creation, deletion and temporary deactivation of charging station users. A distinctive aspect is the possibility of managing the credit associated with each user, providing a flexible mechanism for using electricity even outside working hours. For example, users can recharge their electric cars by paying only for the amount of electricity actually consumed.

The entire system is illustrated in detail through two attached diagrams, clearly outlining the operational flow. The web client was developed using React JS technology and hosted on an Aruba cloud server. Data collection occurs through HTTP requests between the column (connected via WiFi) and the server, supported by PHP scripts. Once the scripts process and send the data, it is stored in a dedicated MySql database.



Mobile Client

The mobile client represents an essential tool for both end users and employees, especially when they occupy workstations monitored by Energy

Controllers. This application is essential for tracking power consumption
of the user, providing detailed data that subsequently feeds analyzes and evaluations
to optimize production processes. The mobile interface allows you to start and stop
Energy Controller, using your personal account with the credentials provided by a
technical manager.

In addition to operational management, the mobile app offers broad visibility on consumption over time,
allowing users to monitor their credit and customize settings
according to your needs. Programmed with React Native, a versatile hybrid framework,
the application can be easily distributed on both major stores, IOS and
Android, with minor changes to the source code.

The mobile app communicates directly with a cloud server hosting the PHP backend,
facilitating the sending and collection of data in the MySql database. Data transmission takes place
through HTTP requests, ensuring an efficient flow of information between the mobile client
and the server. A distinctive element is the use of the smartphone's geolocation for
allow access and blocking of the charging station only when the user is within range
500 meters from it, ensuring accurate control and preventing users not present in
site to erroneously influence the dispensing station.

Currently, the application is available on the Apple store, as we are in a beta phase
testing and the selected testers use exclusively IOS devices.

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