EV charging and planning system

EVOlution

Design Report

EVOlution reduces wait times, maximizes charging flexibility, and ensures better access for all drivers.
It encourages sustainable transportation, contributing to a greener, cleaner planet

Stakeholder's voice

Concept Generation

Challenges

Possible Solutions

Long Queue Issues:
"Charging stations are often in a long queue"

→ ⊕

More charging spots?

Penalty Fee Frustrations:
"I hate moving my car to avoid penalty fee when I'm watching movie"

→ 🕐 🔋

Control you charging time / speed?

Trip Planning Challenges:
"I don't wanna charger's availability affect my trip plan"

→ 📅

"Reserve" a spot in advance?

How can we resolve charging hesitation with limited resources?
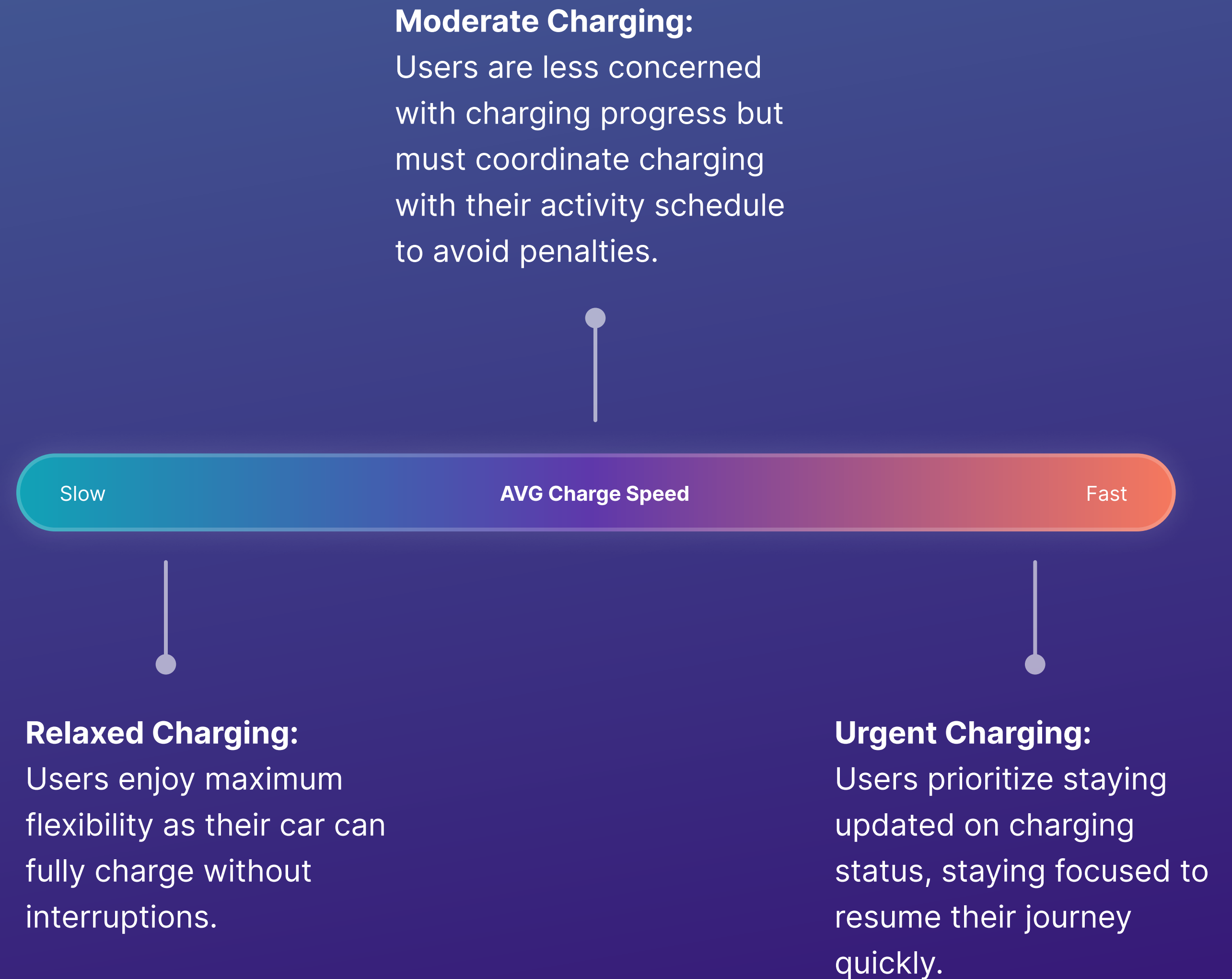
⊕
Quantity

🕐
Time

🔋
Speed

📅
Plan

By acknowledging technological limitations and prioritizing efficiency and user experience, we can develop a practical solution within our project scope (3-5 years).

User interviews revealed major EV charging challenges:
- **difficulty finding chargers**
- **schedules dictated by charging timelines**
- **penalty risks during activities.**

These barriers shape the urgent, moderate, and slow charging scenarios.

Moderate Charging:
Users are less concerned with charging progress but must coordinate charging with their activity schedule to avoid penalties.

Slow   AVG Charge Speed   Fast

Relaxed Charging:
Users enjoy maximum flexibility as their car can fully charge without interruptions.

Urgent Charging:
Users prioritize staying updated on charging status, staying focused to resume their journey quickly.

More Charging Spots
Flex Power Distribution

The idea stems from the challenge of upgrading the "hard" infrastructure, like the power grid, which is costly and time-consuming.
Instead, it's more plausible add the number of charging spots.

Power Grid → **Power Output** → **Charging Spots**
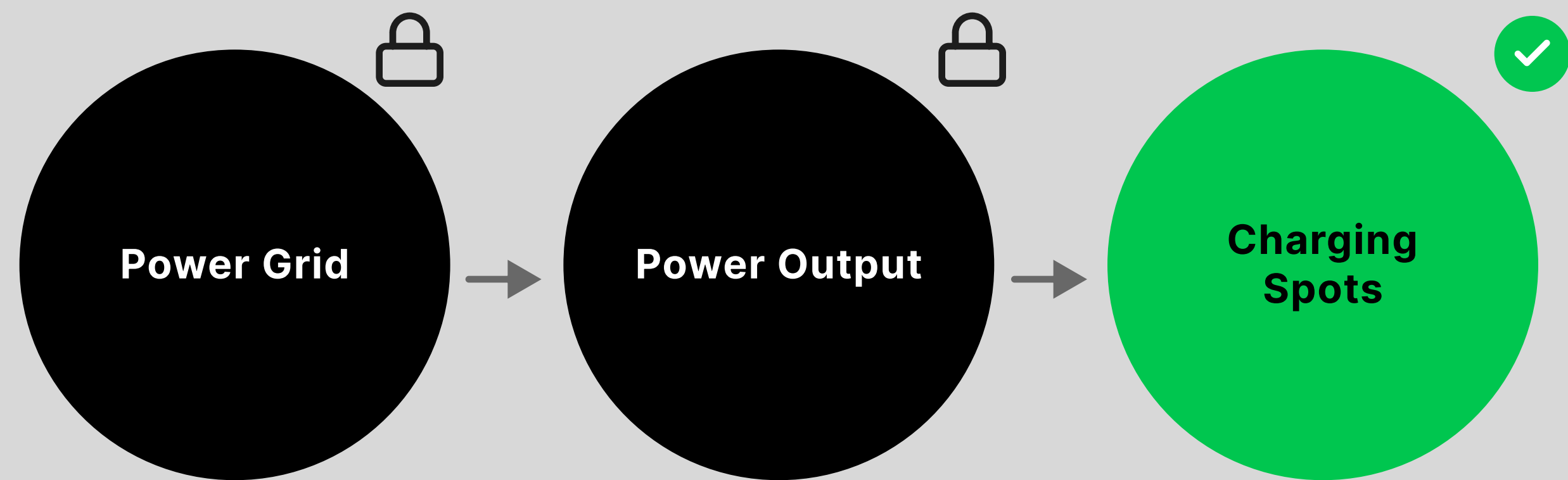
Battery capacity & Charging time

Fast Charge | **Level 2 Charge**

20% | 80% | 100%

EVs typically fast charge up to 80%, while the remaining 20% switches to slower Level 2 charging.
In conventional charging queues, the final 20% takes significantly longer—often as much time as it takes to reach the initial 80%.
As a result, drivers charging to 100% occupy charging spots much longer, leading to a notable loss in queue efficiency.

100kW

100kW | 17kW | 17kW

Additionally, while more chargers now support high-wattage fast charging (e.g., 300 kW), many EVs cannot fully utilize this capacity. By managing power distribution more wisely, we can optimize resources to accommodate more drivers with varying charging needs, improving overall efficiency and accessibility.
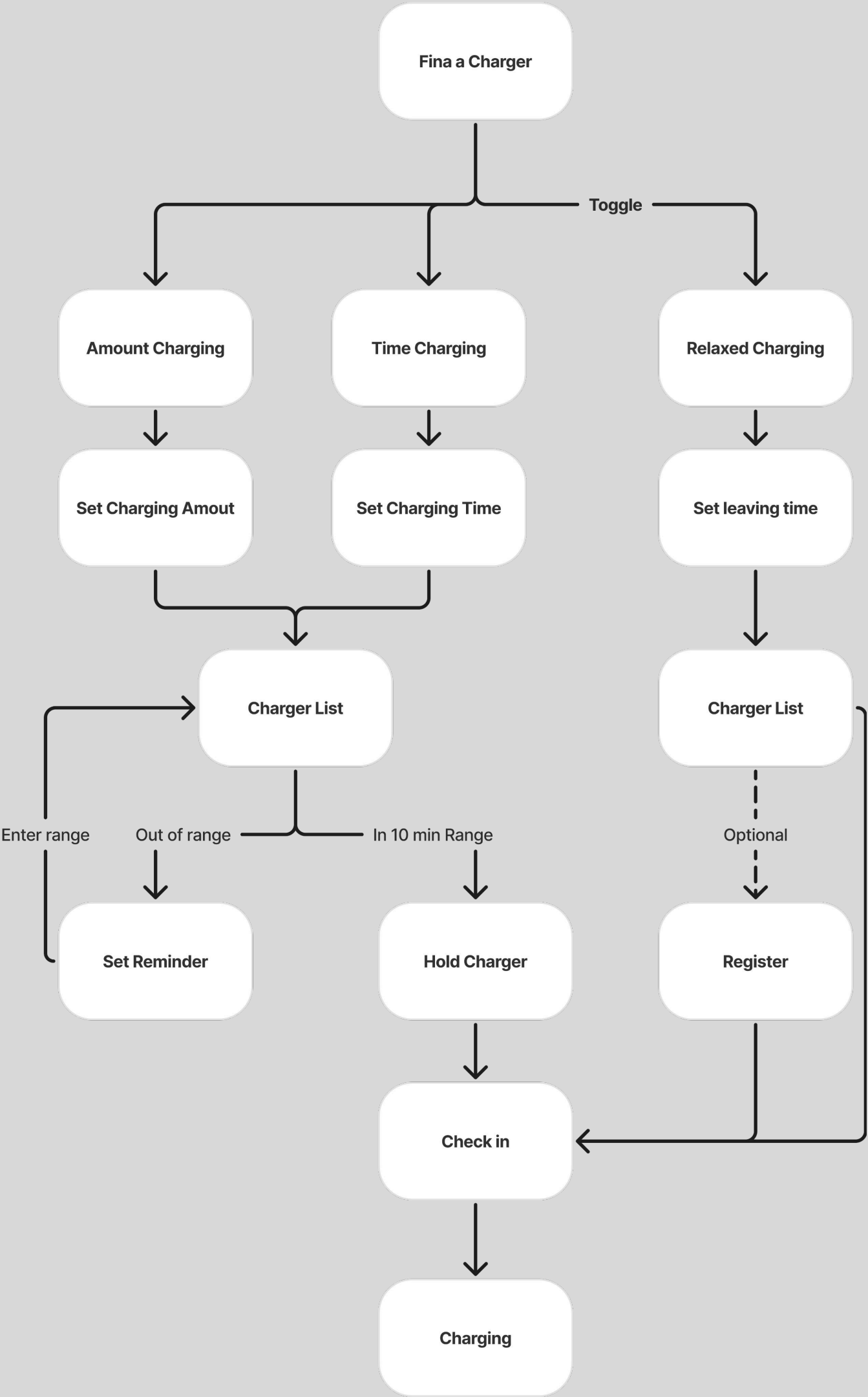
Information Architecture
Iteration #1

The first iteration fully incorporates the three charging methods. Drivers can set their target charging amount or time, and the system provides tailored options. Additionally, drivers can enable Relaxing Charging (Yield Mode), which deprioritizes fast charging to reduce costs per watt and allows for extended parking durations.
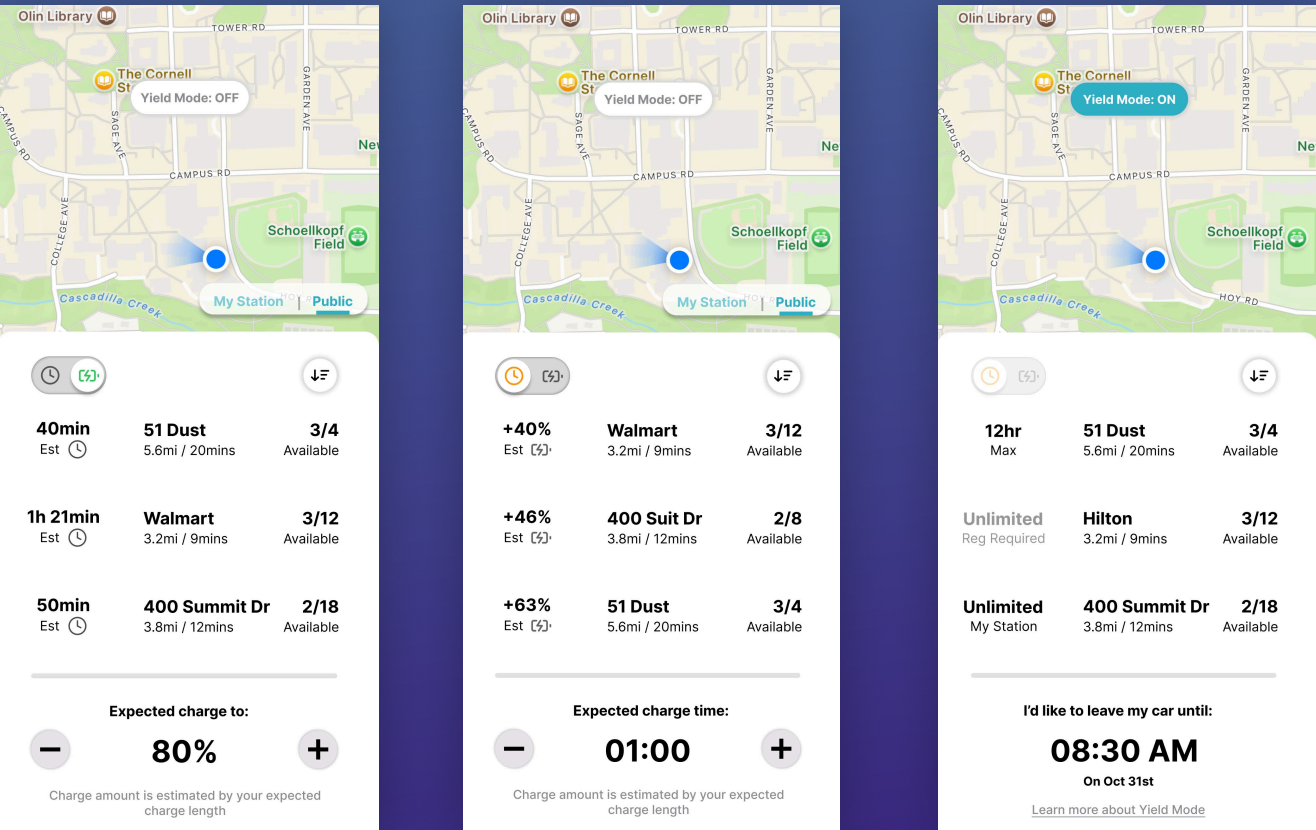
The design provided an abundance of options but is overwhelmed and lacks ability to adapt to unexpected situations.

A driver might leave their car at the charger for several hours without knowing the exact departure time, making it difficult to select the appropriate charging mode.

In other cases, drivers might face unforeseen delays or need to extend their stay, leaving them constrained by rigid upfront decisions.
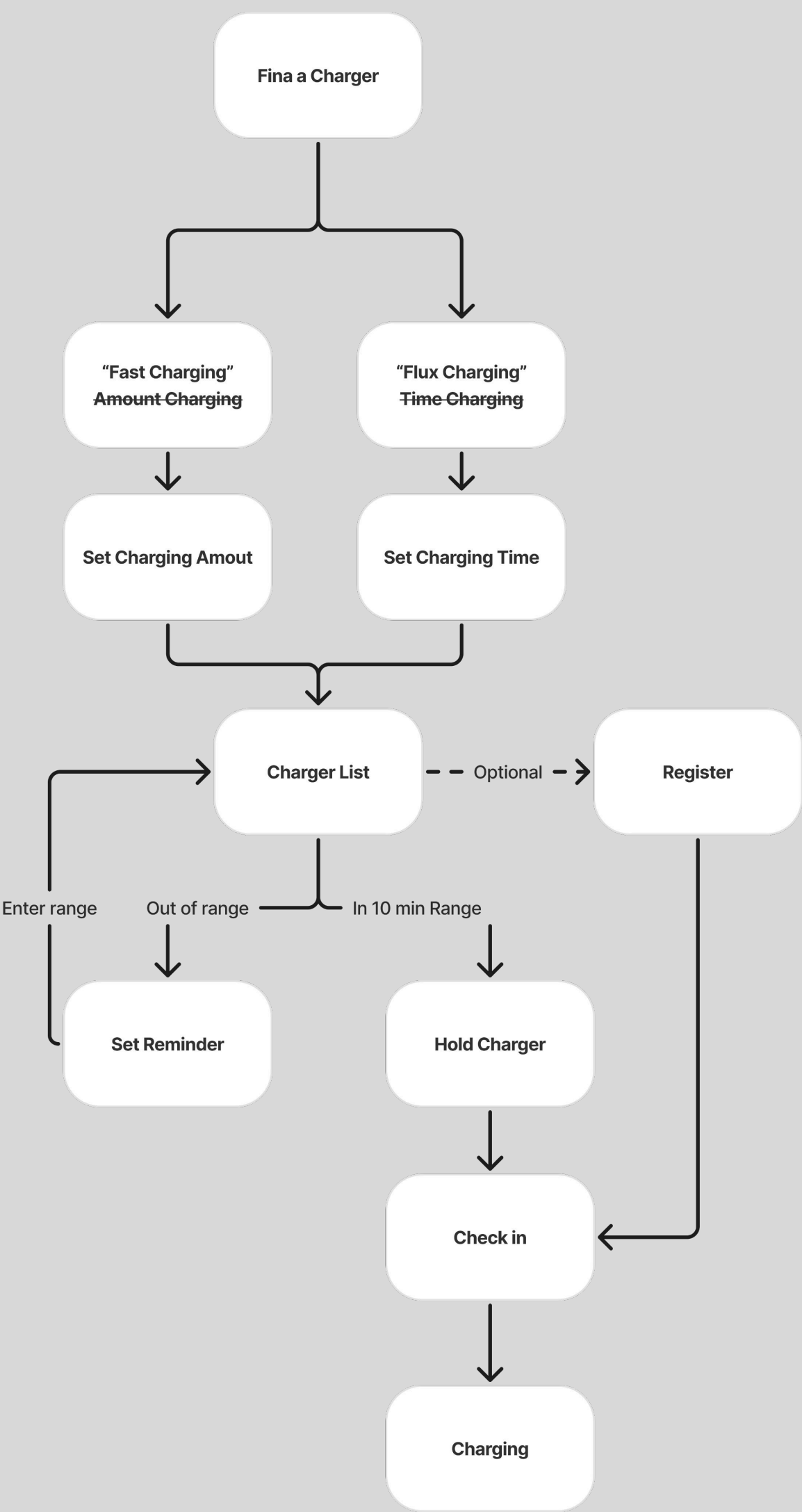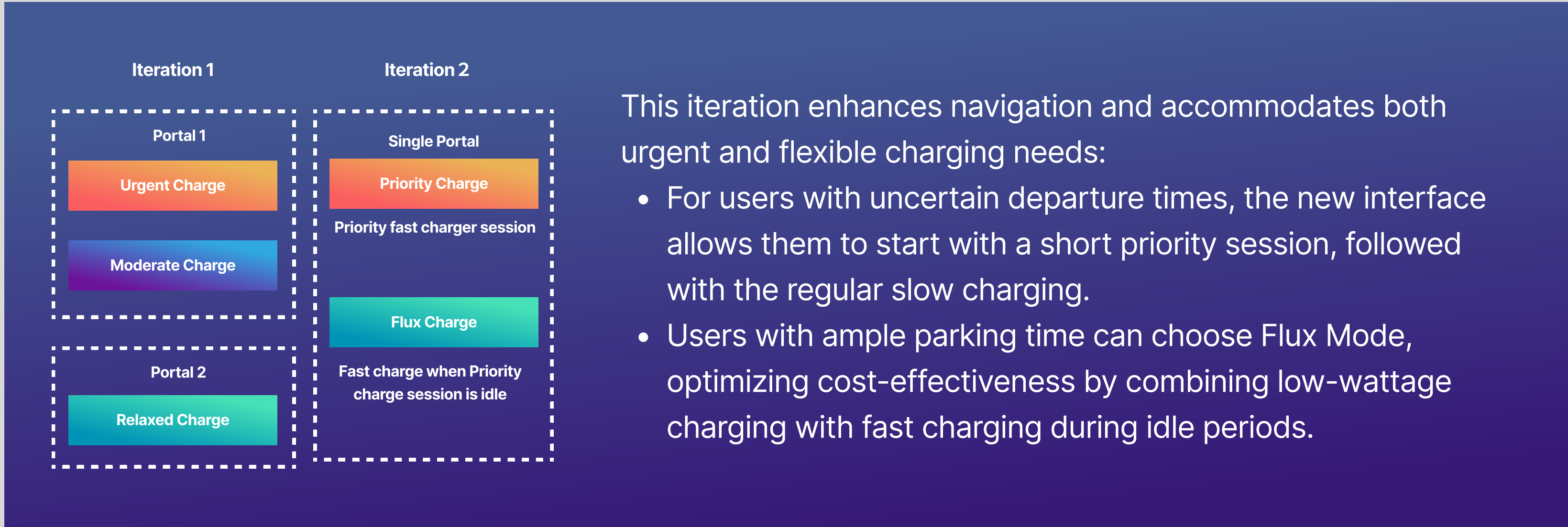
Information Architecture
Iteration #2

The user flow has been streamlined for a more intuitive experience::

1. Unified Portal: Combines all charger-finding features into one streamlined interface.

2. Charging Modes:

- Priority Mode: Fast charging prioritized based on queue, minimizing wait times.
- Flux Mode: Starts with Level 2 charging, switching to fast charging when idle.

Iteration 1

Portal 1

Urgent Charge

Moderate Charge

Portal 2

Relaxed Charge

Iteration 2

Single Portal

Priority Charge

Priority fast charger session

Flux Charge

Fast charge when Priority charge session is idle

This iteration enhances navigation and accommodates both urgent and flexible charging needs:

- For users with uncertain departure times, the new interface allows them to start with a short priority session, followed with the regular slow charging.
- Users with ample parking time can choose Flux Mode, optimizing cost-effectiveness by combining low-wattage charging with fast charging during idle periods.

Fina a Charger

"Fast Charging" ~~Amount Charging~~

"Flux Charging" ~~Time Charging~~

Set Charging Amout

Set Charging Time

Charger List — Optional — Register

Enter range

Out of range

In 10 min Range

Set Reminder

Hold Charger

Check in

Charging

Information Architecture
Final Iteration

The final iteration simplifies and streamlines the workflow further. The interface provides essential information to help users plan their charging: the next available fast charging session for Priority Mode and current idle spots for Flux Mode.
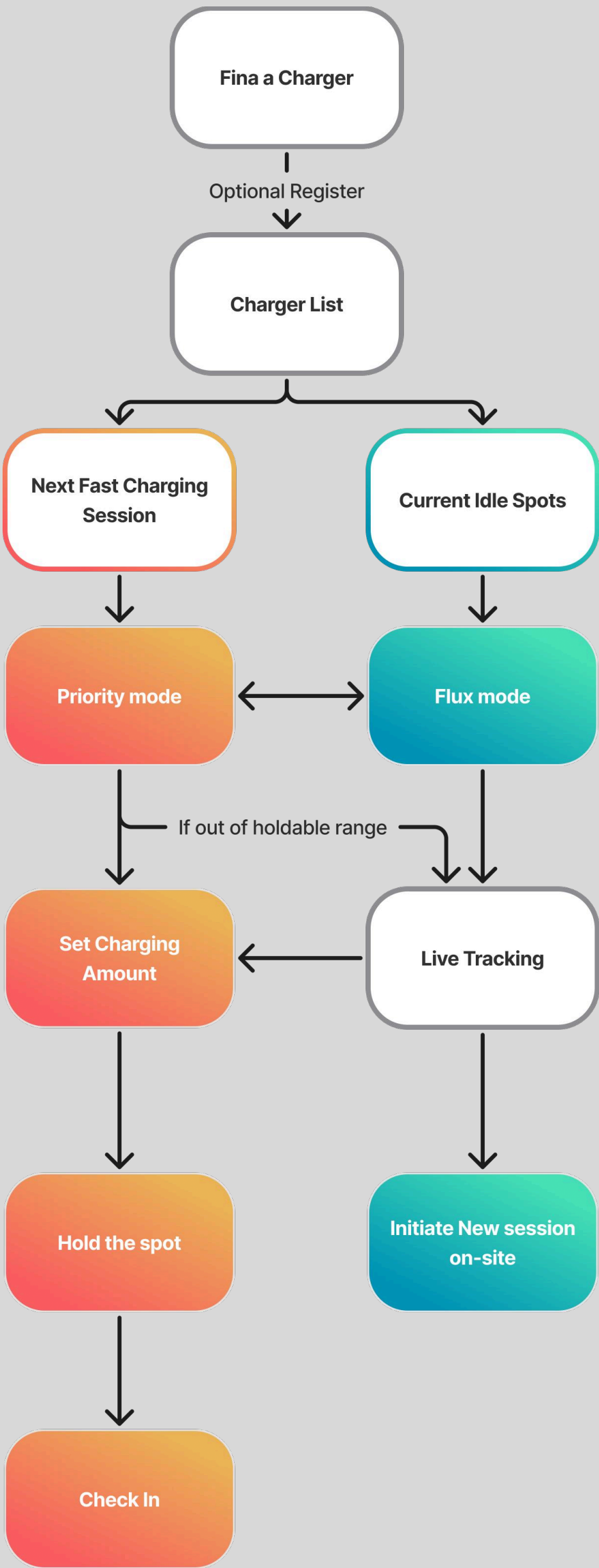 • In Priority Mode, users set a charging amount before holding a spot.
 • In Flux Mode, users no longer need to set a charging time. They can track idle spots in the app and initiate a session on-site on a first-come, first-served basis.

Q: Why do users need to set a charging amount for Priority Mode?

A: Setting a charging amount helps the system estimate the required charging time based on the user's car model. This enables accurate predictions for the next available session, improving queue management for other users.
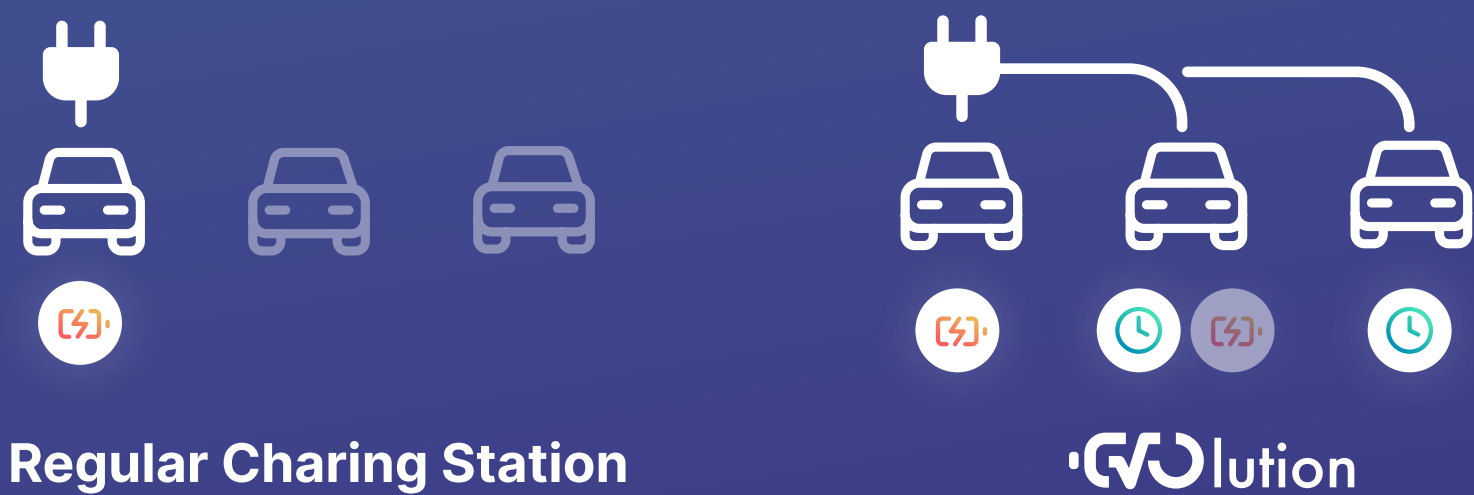
Q: Why can users only hold a spot within a certain driving distance?

A: Limiting holds to a specific driving distance ensures real-time alignment between the user's arrival and the charging schedule, preventing unnecessary delays for other drivers.

Fina a Charger

Optional Register

Charger List

Next Fast Charging Session

Current Idle Spots

Priority mode

Flux mode

If out of holdable range

Set Charging Amount

Live Tracking

Hold the spot

Initiate New session on-site

Check In

Final design feature highlights

EVOlution

Regular Charing Station

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EVOlution allows up to four cars to plug in simultaneously. It prioritizing fast or flexible modes based on user needs, maximizing efficiency and reducing wait times.

EVOlution features up to four versatile charging outlets, all supporting both fast and slow charging options to adapt to user preferences.
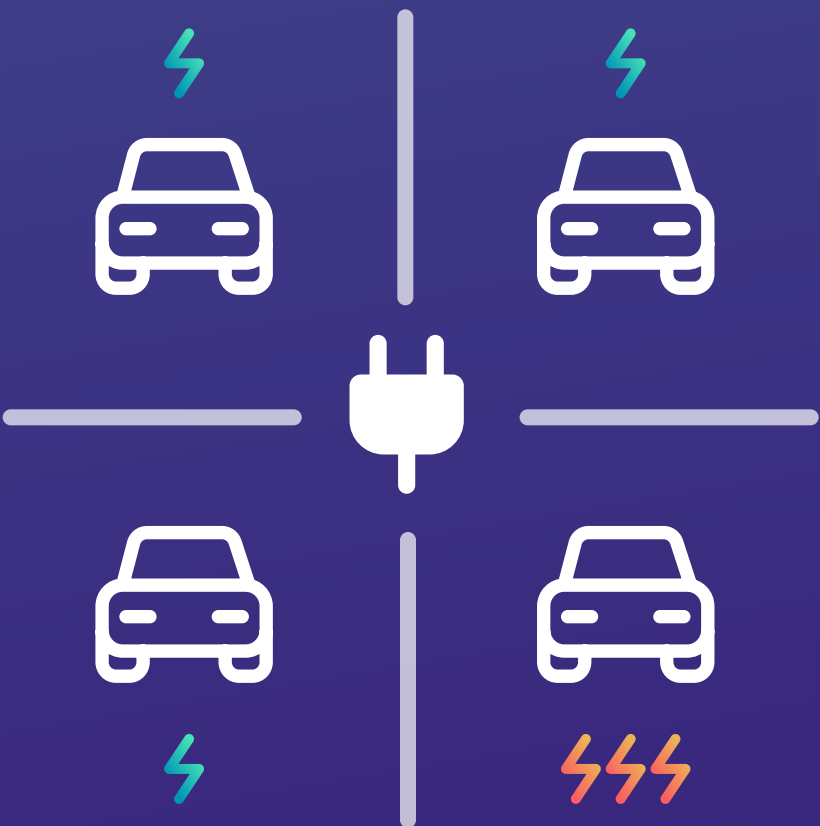
Its dynamic voltage system adjusts power based on selected charging modes.
Priority mode for fast charging up to a set battery level.
Flux mode starts slow charging, switching to fast charging when available.

Priority Mode:
Level 3 DC Fast Charge

Flux Mode:
Level 2 DC Charge
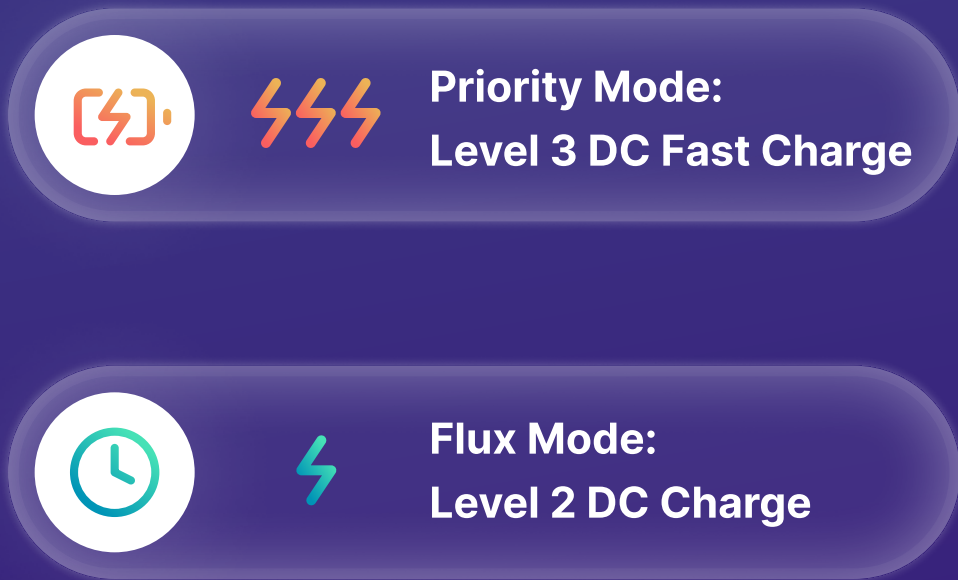
A Charger adapts your needs

Flexible Charging Options:
Allows users to prioritize speed or cost, addressing both urgent and relaxed needs.

Queue Management:
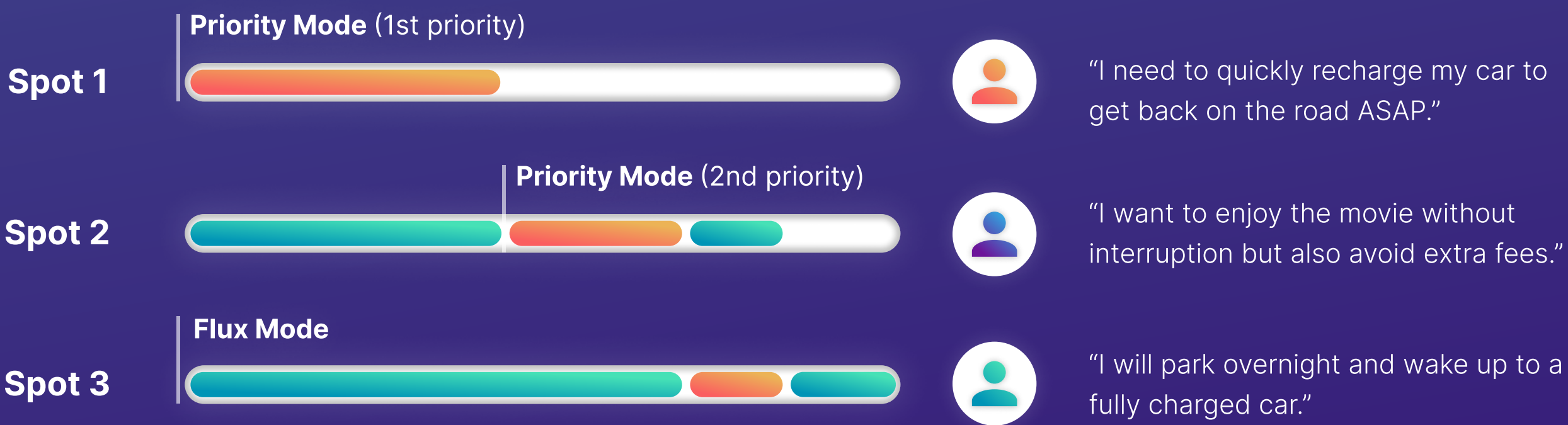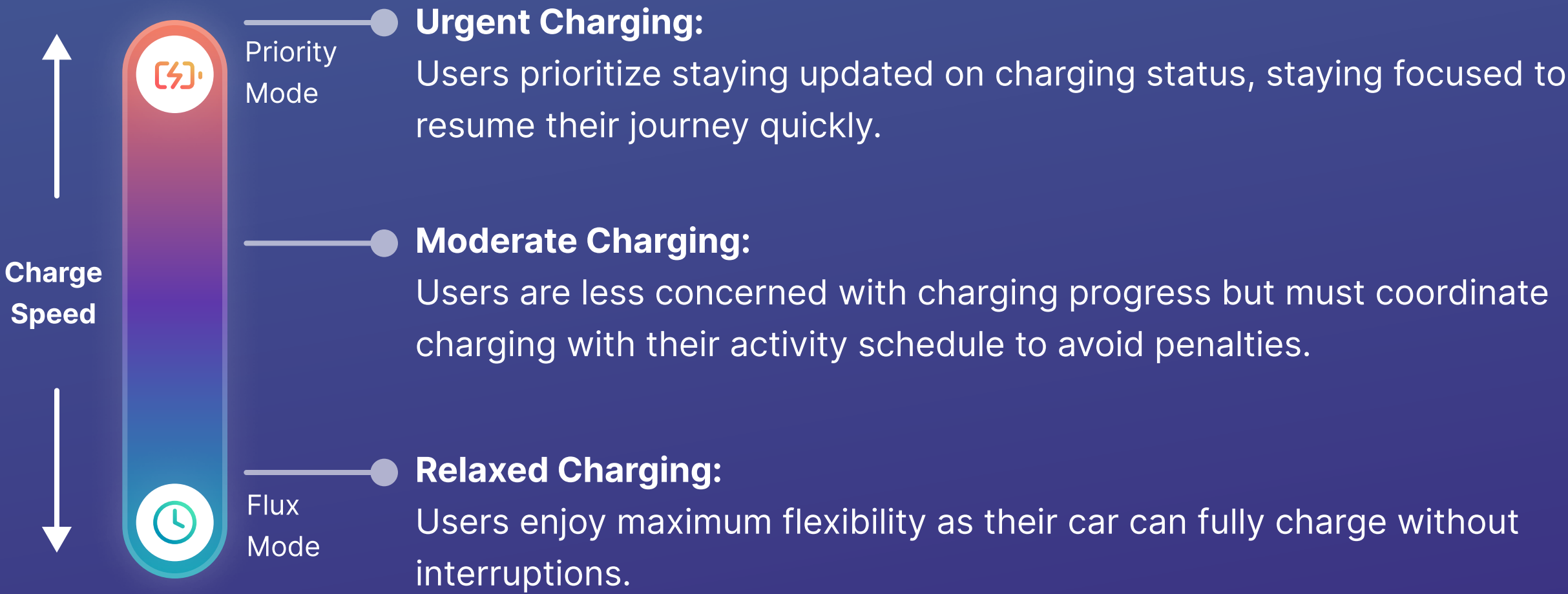Minimizes wait times and improves access to fast charging for those who need it most.

Dynamic Wattage Adjustment:
Ensures all ports support both fast and slow charging, addressing availability and user preferences.

Extra Parking Spots:
Reduces pressure to move cars immediately after charging, offering users greater freedom to plan.

EVOlution hosts three charging conditions with using two charing modes:

Charge Speed

Priority Mode

Urgent Charging:
Users prioritize staying updated on charging status, staying focused to resume their journey quickly.

Moderate Charging:
Users are less concerned with charging progress but must coordinate charging with their activity schedule to avoid penalties.

Flux Mode

Relaxed Charging:
Users enjoy maximum flexibility as their car can fully charge without interruptions.

Spot 1 — **Priority Mode** (1st priority)
"I need to quickly recharge my car to get back on the road ASAP."

Spot 2 — **Priority Mode** (2nd priority)
"I want to enjoy the movie without interruption but also avoid extra fees."

Spot 3 — **Flux Mode**
"I will park overnight and wake up to a fully charged car."

When a charger serves three cars with different needs, Priority Mode allows an urgent driver to quickly charge up to 80%, while a relaxed driver uses Flux Mode for flexible, low-wattage charging. A moderately urgent driver can also use Priority Mode to charge a small amount quickly and finish the rest with regular Level 2 charging

Final design
Phone App and Charger Interface

The phone app integrates seamlessly with the charger interface, offering a comprehensive and user-friendly experience. Users can search for chargers, track idle spots in real time, and hold a charging spot for Priority Mode if within the designated range.
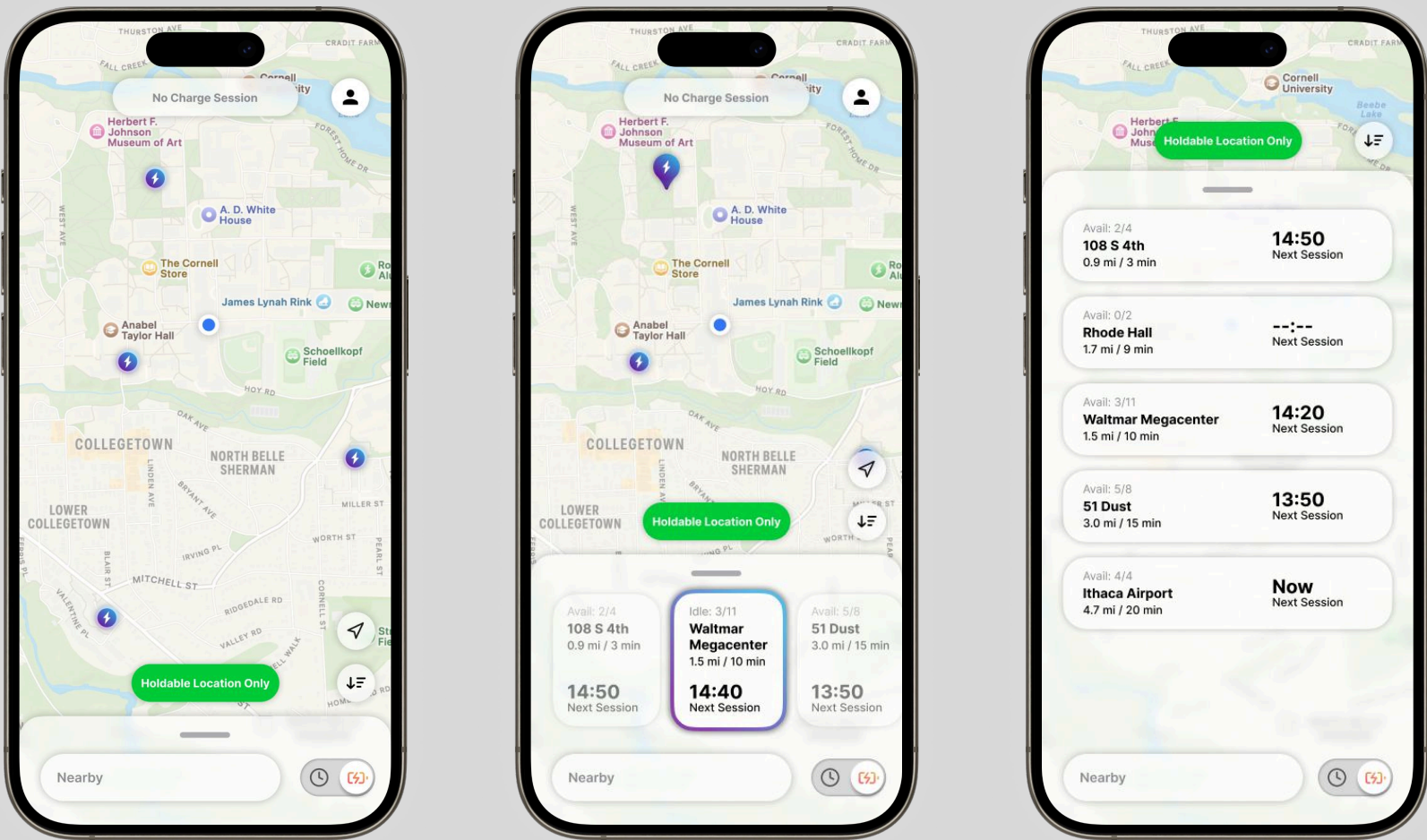

Once at the charger, they can check in, initiate a new session on-site, and monitor their charging progress directly through the app. This streamlined connection ensures convenience and flexibility for a wide range of charging needs.

Phone App

Charger Finder

Map View

Hybrid View

List View

The phone app offers list, hybrid, and map views to locate chargers. List view provides detailed charger information for quick comparisons, map view offers a visual layout for route planning, and hybrid view combines both for a balanced approach. This flexibility ensures a smoother search experience.

Info Card

Avail: 3/11
Waltmar Megacenter
1.5 mi / 10 min

14:20
Next Session

The information card provides comprehensive overview helps users make informed decisions by quickly evaluating charger availability, accessibility, and timing to suit their needs.

Plan and tracking
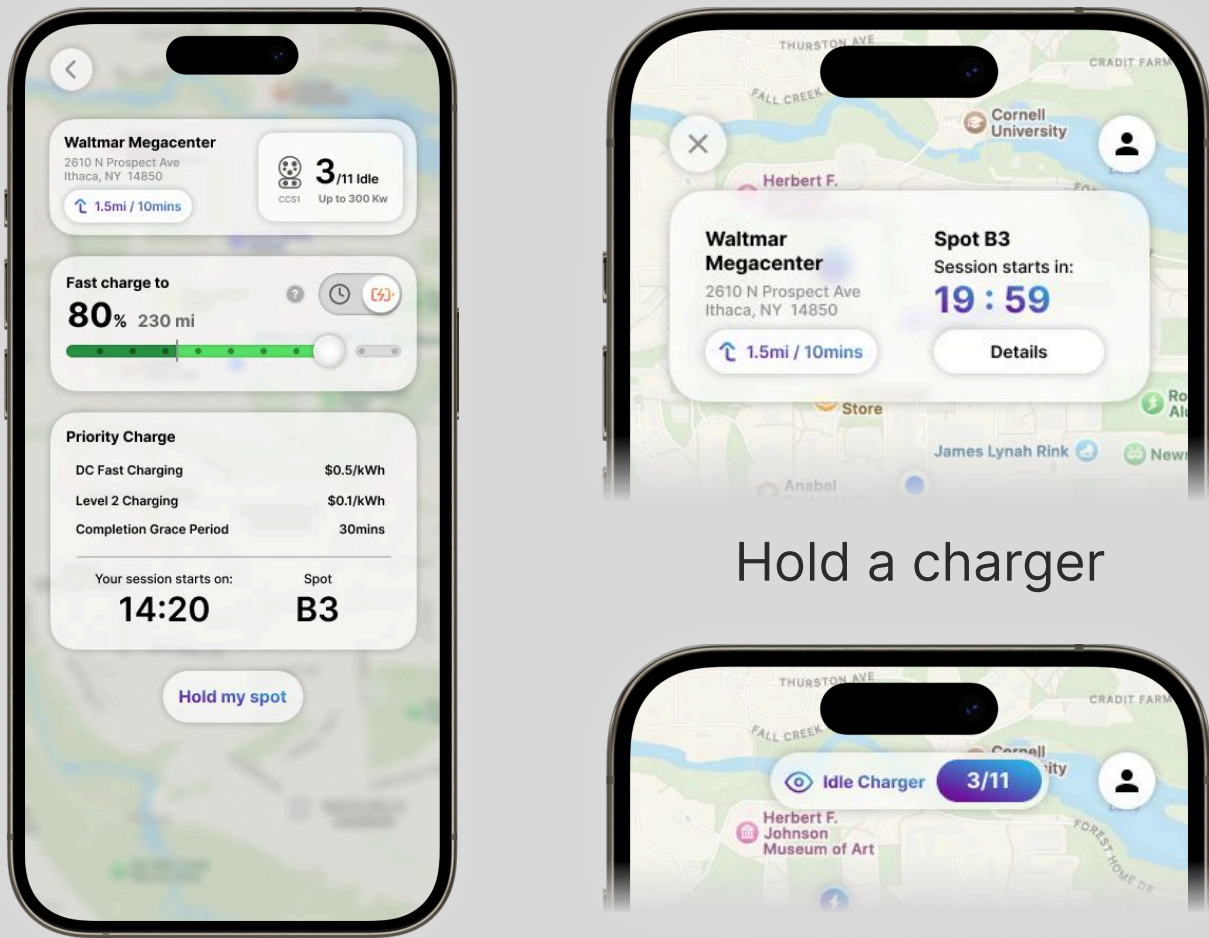
Plan charging

Hold a charger

Track a station

After holding or tracking a charger, users can view the live status, including the holding countdown, navigation to the charger, and real-time spot availability, all at a glance through the top widget.

Design and highlights

Charger Interface

Homepage portals
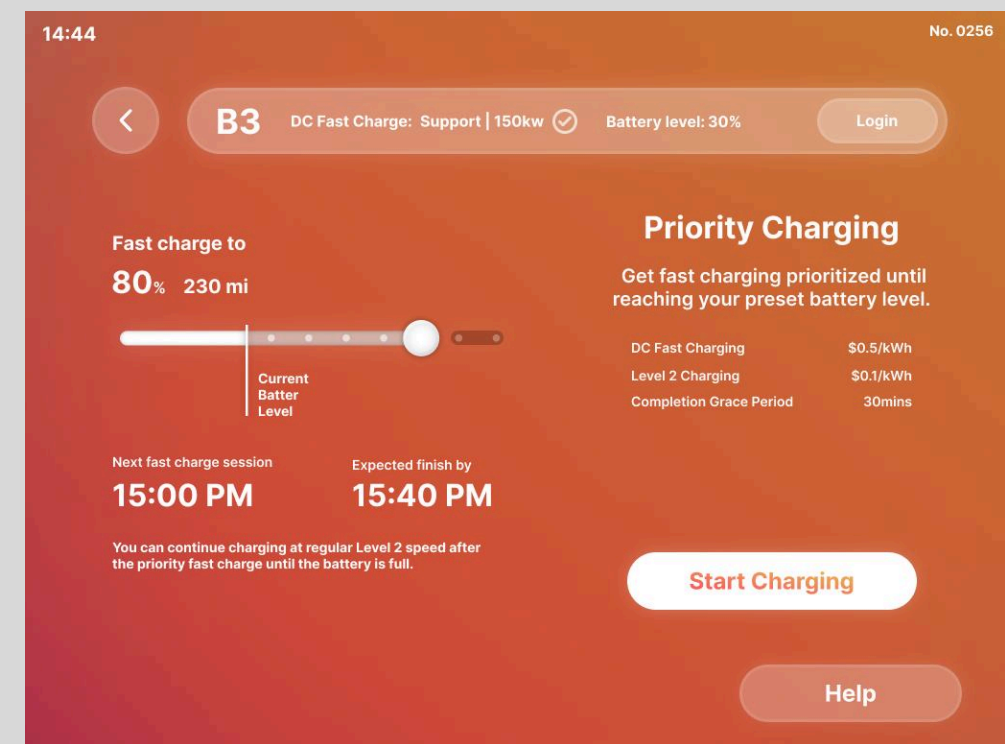

New session onsite

Priority Charge

Flux Charge
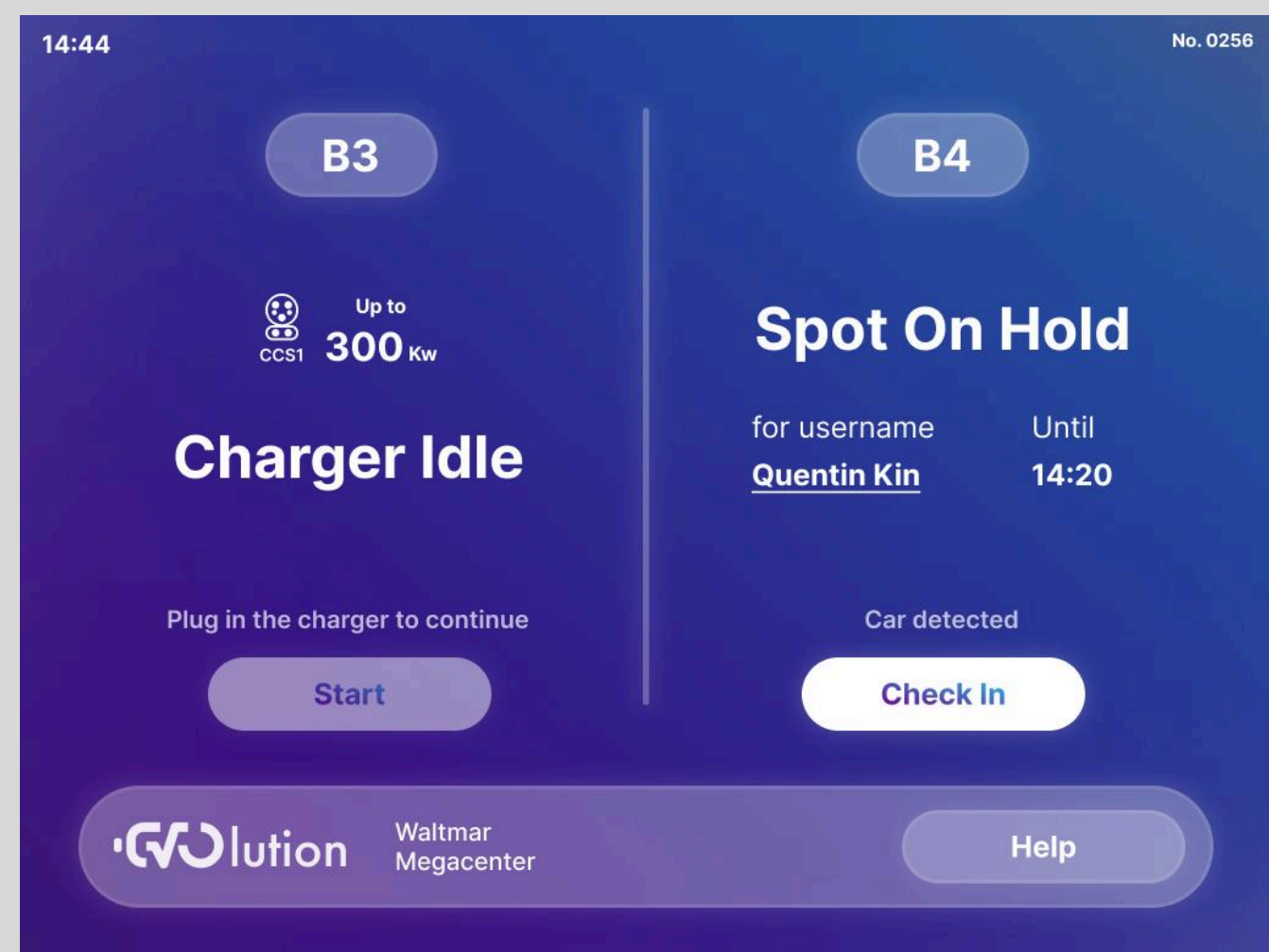
The charger's interface features intuitive portals based on its structure. For example, as shown in the image, it includes two portals, "B3" and "B4," indicating that the display corresponds to and faces spots B3 and B4. This ensures clarity and helps users easily identify their designated charging spot.
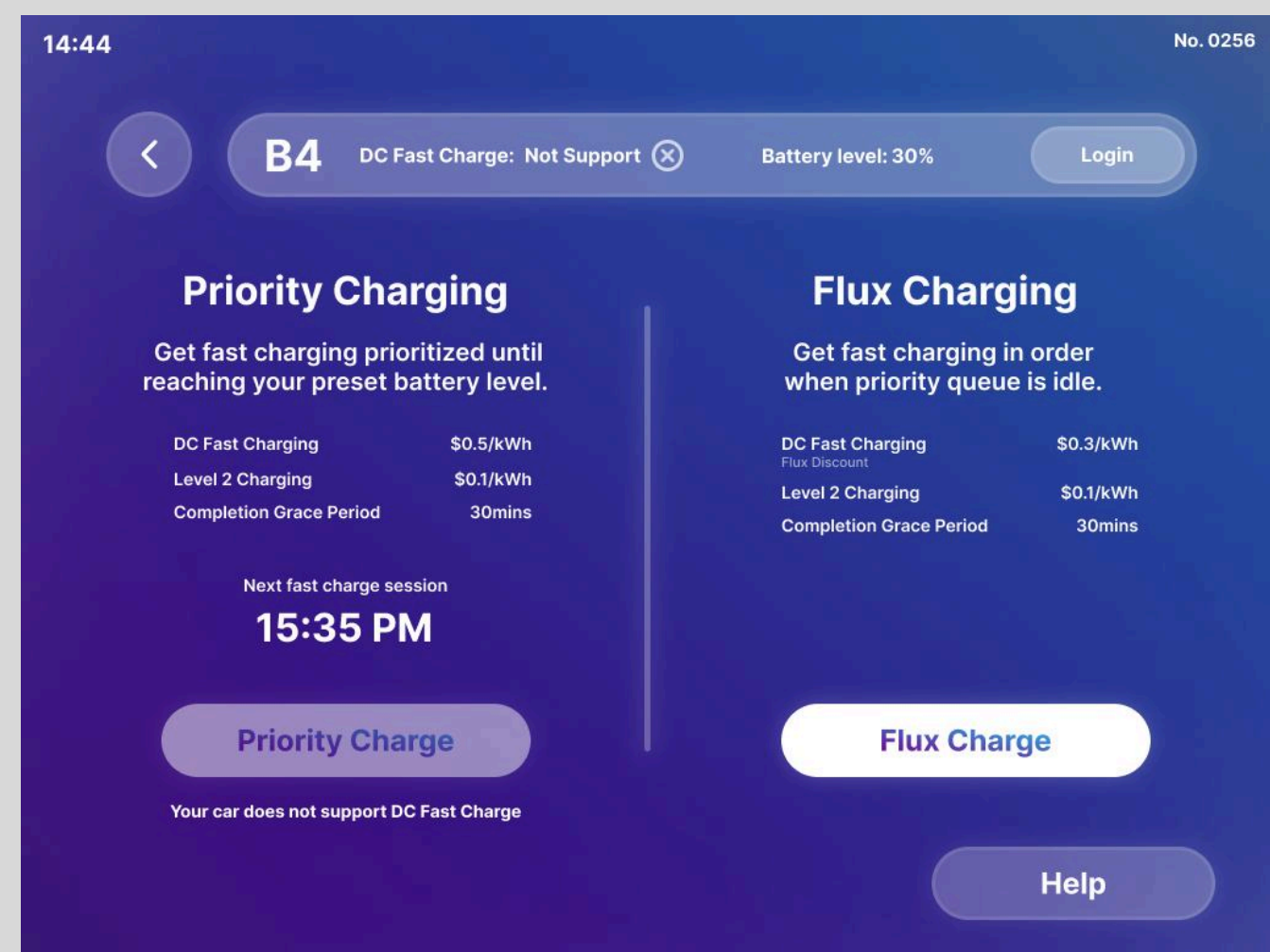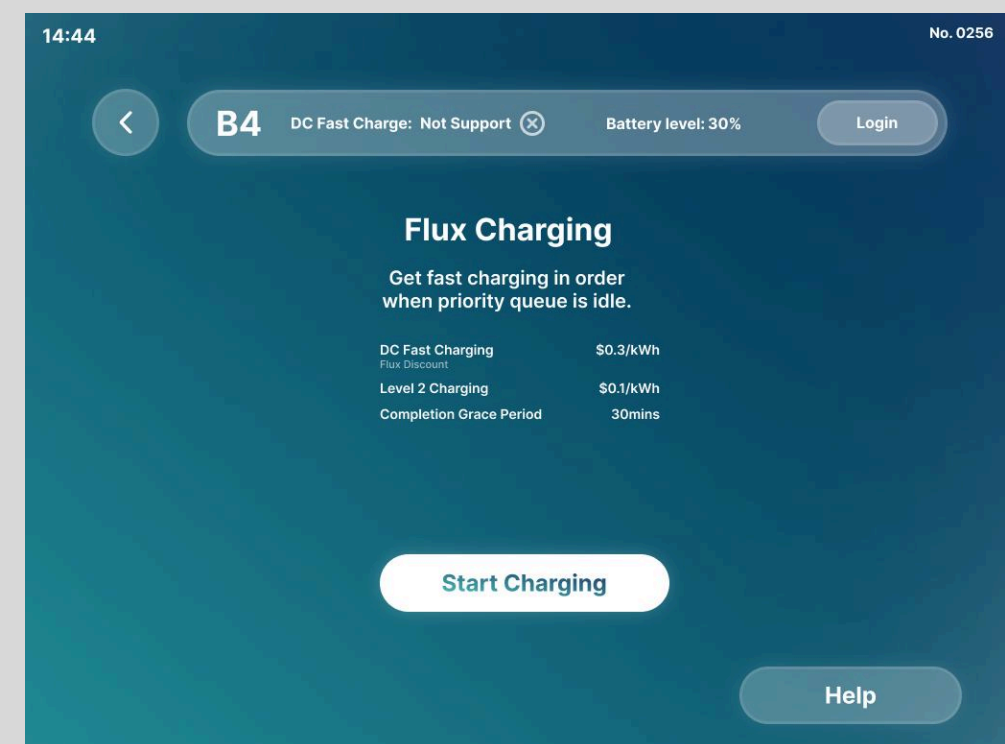
Users can initiate a new charging session directly on the charger, following the same simple and intuitive workflow as on the phone. This consistency ensures a seamless experience across both platforms.

Design and highlights
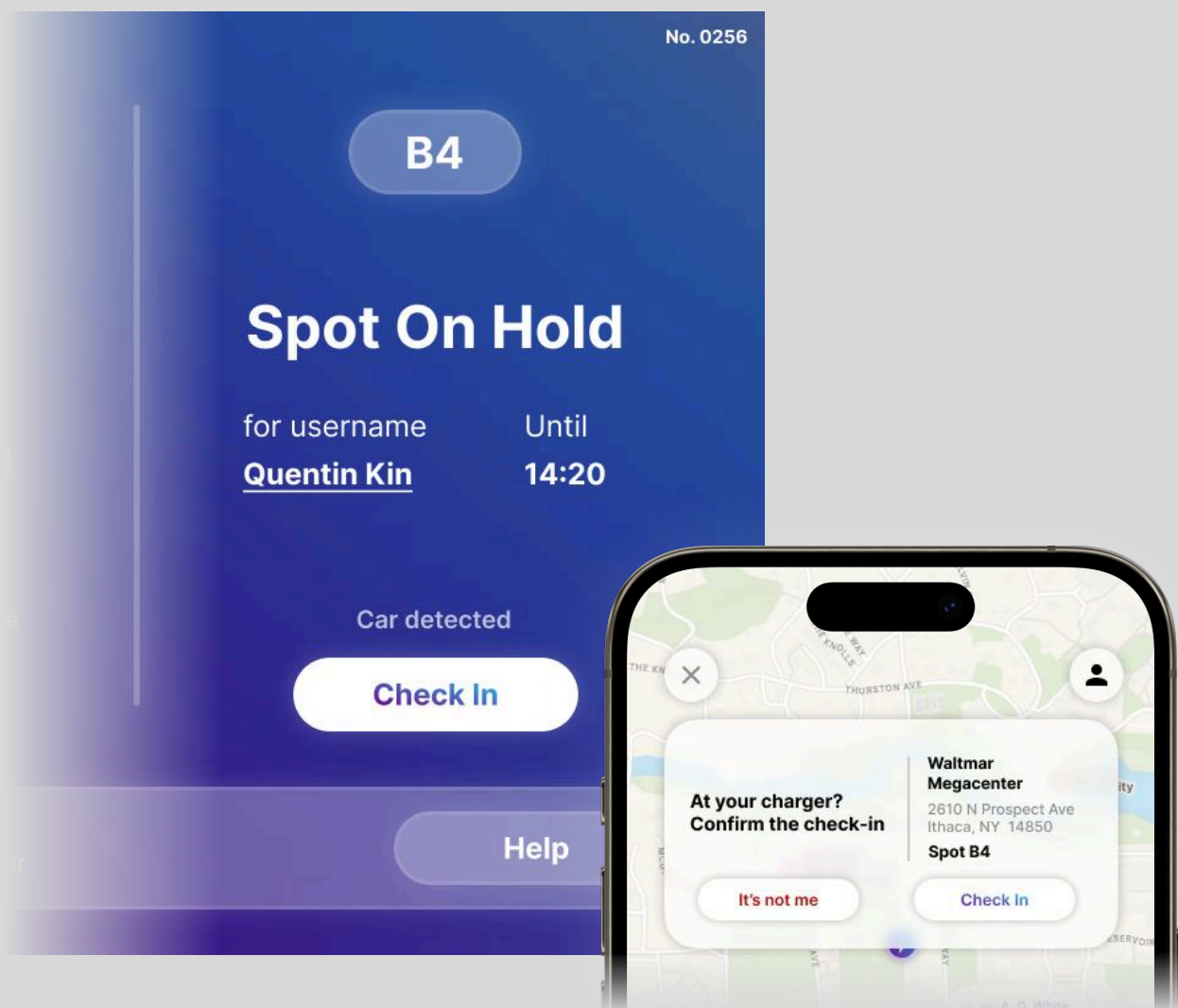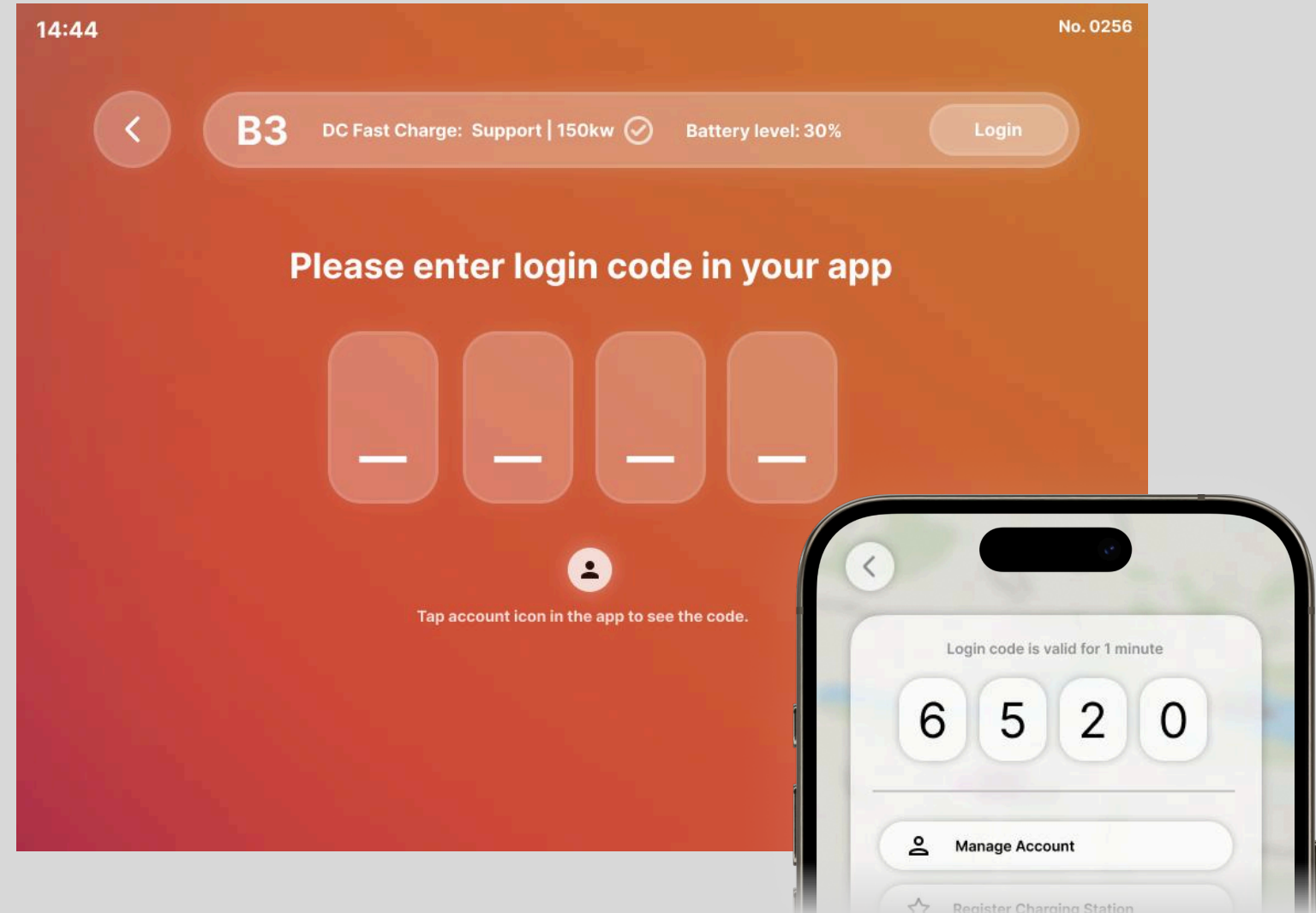# Charger Interface

Check-in

Users can check in their hold directly on the charger interface. To prevent accidental inputs, the phone app prompts users to confirm the check-in after pressing the check-in button on the charger.

Login

Users can log in to the charger using a real-time generated login code. This syncs their profile and payment methods, enabling faster transactions and allowing them to track charging progress seamlessly.
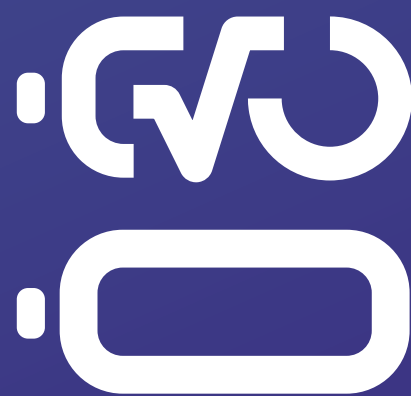
Charging Monitor

Both the charger interface and the phone app display the current charging progress in real-time, ensuring users can monitor their session conveniently from either platform.

Logo and Color Language

EVOlution

The stacked "EVO" letters form the silhouette of a battery, reinforcing the focus on charging and energy efficiency

Letter V:
Shaped like a fluctuating line, it represents the dynamic system that adjusts based on user needs.

Letter O:
A three-fourth circle, resemblance to a pancake that symbolizing dynamical arrangement of charging schedules.

Gradient Purple-Blue:
The primary color scheme sits between green and orange, symbolizing balance and adaptability. Purple evokes a futuristic and innovative feel, reinforcing the advanced nature of EVOLUTION's system.

Gradient Orange-Red:
Represents urgency and speed, echoing the fast-charging mode for users prioritizing efficiency.

Gradient Green (Green-Blue):
A calming, middle-tone green that reduces visual fatigue. It conveys environmental sustainability, relaxation, and aligns with the relaxed charging mode.
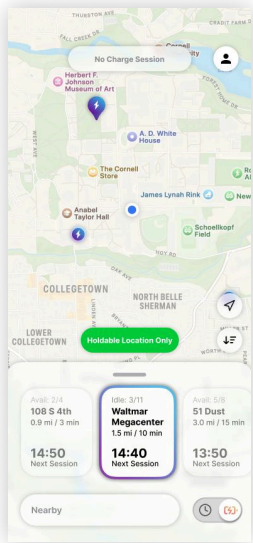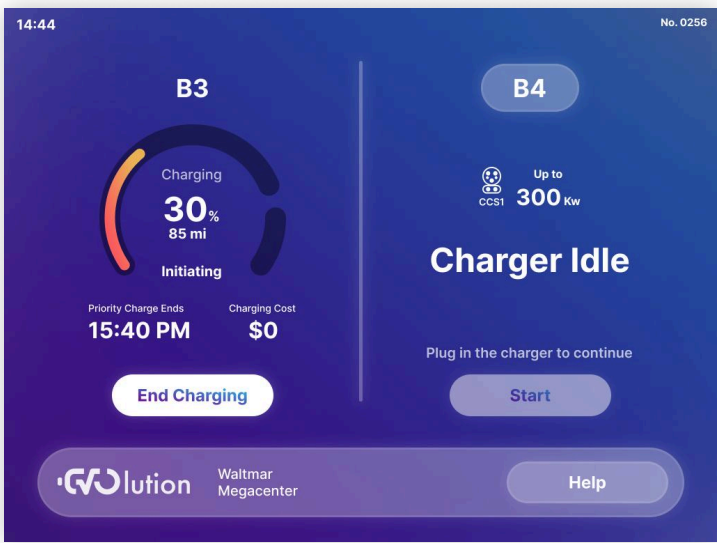
The phone app uses a plain-white base with subtle brand colors to minimize visual fatigue, ensuring simplicity for frequent use.
In contrast, the charger interface boldly features brand colors to reinforce identity and aid navigation, especially for new users without the app.