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D3.5 Revised Natural User Interfaces

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List of abbreviations

Abbreviation	Term
A&M (Interface)	Aggregator and Market (Interface)
AFM	Automated Flexibility Management
AI	Artificial Intelligence
API	Application Programming Interface
BRP	Balance Responsible Party
CO_2	Carbon dioxide
CSS	Cascading Style Sheets
DR	Demand Response
DTR	Digital Twin Repository
HTML	Hypertext Markup Language
iFA	iFLEX Assistant
JSON	JavaScript Object Notation
JWT	JSON Web Tokens
MVC	Model-View-Controller
oBIX	Open Building Information Exchange
PUC	Primary Use Case
RAI	Resource Abstraction Interface
REST	Representational State Transfer
RWD	Responsive Web Design
SO	System Operator
SQL	Structured Query Language
SVG	Scalable Vector Graphics
TLS	Transport Layer Security
UC	Use Case
UI	User Interface

Executive summary

The iFLEX project aims at enabling Consumers and/or Prosumers at the level of individual premises or at the level of a community to improve the energy and sustainability performance of their premises and enter the energy and flexibility markets by offering demand side flexibility services to relevant market actors. From the perspective of these actors, various Flexibility Procurers, e.g., System Operators (SOs), Balance Responsible Parties (BRPs), can leverage flexibility from small-scale end users of the power system.

This deliverable falls within Task 3.3 of the project, which concerns the development of user interfaces that facilitate the interaction of end users with their iFLEX Assistants (iFAs). The objectives of this report are on one side to document the updated design and implementation achievements of the User Interface (UI) component of the iFA, whilst on the other to provide the guidelines for the next steps of the development process for supporting the second phase of piloting, focusing especially on integration with other iFA components and leveraging the experience gained from the pre-piloting experimentation phase.

The design work was based on the use cases documented in D2.1 [1] and on the set of more granular requirements concerning iFA's UI component – devised during the system analysis and documented in the Appendix of this report – as well as the revised common architecture of the iFLEX Framework described in D2.4 [2]. The co-creation activities with iFA end users, which will assist in the process of redesigning the application, as well as adding new features to it, are also summarised in this deliverable. It is noted that this report complements and updates the work presented in D3.4 [3], which documented the initial specifications for iFA's Natural User Interfaces.

The envisioned functionalities of the UI module in Phase 2 are reported by referring to the relevant requirements, based on the prioritisation agreed with the three pilots of the project and the achievements of Phase 1. Furthermore, the design of the UI solution is analysed via three architectural views:

- Context view, presenting the interactions of the component with its environment at a high level;
- Functional view, focusing on the functionalities of the various sub-components of the UI;
- Implementation view, documenting the technology stack for the instantiations of the UI module per pilot.

Finally, the updated UI design of the first phase prototypes for the three pilots of the project is presented.

This document will serve as a guide with respect to the UI component for the development, integration, and piloting process in Phase 2 of the project. According to the agile approach of iFLEX, future developments and additional functionalities relevant to the Natural User Interfaces will be reported in the third deliverable of Task 3.3, namely D3.6.

1 Introduction

The iFLEX project is a response to the call LC-SC3-EC-3-2020, entitled “Intelligent Assistants for Flexibility Management”, of the Horizon 2020 program. Key objectives of the iFLEX project are:

- To develop AI-enabled modelling, optimisation and user interface methods for consumer flexibility management and load forecasting;
- To design and develop modular, secure and interoperable interfaces and data management services for consumer flexibility management;
- To design and implement novel user engagement, incentives, and market mechanisms for consumer-centric demand response, whilst respecting consumer rights.

The various components developed by the solution providers who are involved in the project will be integrated into a holistic software framework for flexibility and energy management, namely the iFLEX Framework. Based on this framework, application-specific iFA prototypes, customised for services provided by the industrial partners of the project, will be deployed and tested through pilots in three different countries, namely Finland, Greece and Slovenia.

This document falls within Task 3.3 of the project, which is responsible for developing user interfaces that will facilitate the interaction of end users with their iFAs.

1.1 Purpose, context and scope

Based on the agile approach of the iFLEX project, there will be three deliverables on Natural User Interfaces corresponding to the three phases of the project’s implementation. The current document, D3.5, has two main objectives:

- To guide the development process of the iFA’s User Interface (UI) component via documenting relevant requirements, which are mainly focused on the 2nd phase of the project.
- To facilitate quick integration amongst the UI and other iFA components. Hence, the up-to-date development progress on the UI is documented as a base.

It is noted that this is the second deliverable of the Task 3.3, as the initial UI module is reported in the D3.4 [3] of iFLEX project.

1.2 Content and structure

Addressing the main objectives of the project’s tasks contributing to this report and its audience, this document is structured as follows:

- Chapter 1, the present section, is an introductory chapter to the report. The chapter also provides a summary of changes compared to the D3.4 in Section 1.3;
- Chapter 2 provides an overview of the iFA’s UI, focusing on the achievements of the first phase, the planning of the second phase, and the UI-related co-creation activities;
- Chapter 3 presents the documentation of implementation aspects of the solution, considering different system architecture views and the up-to-date UI design;
- Chapter 4 concludes the report with main outcomes and future steps.

1.3 Summary of changes compared to D3.4

This section summarises the changes compared to the initial document on Natural User Interfaces (D3.4). First of all, this report does not provide any material on the employed methodology and approach of Task 3.3, nor on the UI solutions existing prior to the start of the project in certain pilots, since there is no difference compared to the documented content in D3.4 [3], to which the reader can refer if relevant information is needed. Information on iFA end users and the relation to iFLEX Framework architecture is also omitted in D3.5, as relevant content is included in D3.4’s “Overview” chapter. Instead, in the “Overview” chapter of this report, the focus is on the achievements of Task 3.3 in Phase 1, the planning for Phase 2, and the co-creation activities that pertain to the UI.

As concerns Chapter 3 on implementation, the sub-components of the UI module are presented in the functional view. The implementation view of the UI is introduced in D3.5, exposing the technology stack of iFA's UI component in each one of the three project pilots. The chapter also includes an updated version of the UI design, which presents the first phase prototypes of the web and mobile applications – deployed respectively in the Greek and Slovenian pilots – for residential end users, as well as the prototype of the web application for the Finnish apartment buildings.

Furthermore, the documentation of requirements, which can be found in the Appendix, is updated with recently identified requirements and the prioritisation for Phase 2 of the project. The Appendix also presents through mock-ups the suggested UI design for some of the new features of the application in the second phase. Lastly, it is noted that an updated version of the information view, which presents the UI-related information objects, was reported in D2.4 [2], which concerns the revised iFLEX Framework architecture.

2 Overview

This chapter provides the reader with an overview of the iFA's UI by presenting the achievements of the first phase and the planning of the second phase of the project with respect to the UI.

2.1 Achievements of 1st phase

The achievements of Phase 1, which are relevant to the UI, are reported in this section via a concise description of the supported functionalities per pilot, as well as references to the respective requirements. A more detailed description of all the UI-related requirements can be found in the Appendix (section 7.1) of this deliverable.

2.1.1 Greece

The prototype applications developed during the first phase of the Greek pilot enabled the users to choose the level of automation of energy management realised by iFA, by activating or deactivating auto mode (FN-UI-05), as well as by customising and activating scheduled and flexible operation modes according to their will and preferences (FN-UI-01). While editing these modes, the users are able to provide the iFA with their time and operational constraints (FN-UI-02). Moreover, the iFA end users can select the objectives, upon which the energy optimisation of their premises is based (FN-UI-04).

As regards the Demand Response (DR)-related functionalities of the UI, the iFA provides its users with the ability to impose both temporary and permanent pause on DR – as well as on other types of – notifications (FN-UI-09). When auto mode is disabled, DR event notifications (FN-UI-21) are presented to the users, who are subsequently asked to provide their acceptance for the system-proposed schedules concerning their flexible assets (FN-UI-08). Finally, the users are able to inspect their DR participation history (FN-UI-22) via their iFA. The application was built as a responsive web application.

2.1.2 Slovenia

The described functionalities in the previous sub-section for the Greek pilot are also supported by the prototype mobile application, which was developed for the Slovenian pilot of iFLEX during the first phase. Moreover, the end users had the ability to monitor their real-time (FN-UI-11) and past energy data (FN-UI-12). The application was built as a native mobile application.

2.1.3 Finland

During the first phase, an initial version of the end-user interface for the residents of the building community was developed. The residents have access to their own building data with a specific web application. The CO_2 footprint is also calculated for consumed energy, using useful information and data related to electricity generation (FN-UI-10). Users can give feedback anytime about their thermal comfort with 7-scale rating input and free text input (FN-UI-03). Specifically, registered users have a possibility to have thermal sensors installed in their apartment, measuring temperature and humidity. Hence, registered users can view their own apartment's thermal data and their feedback on thermal comfort is addressed to their own apartment, whereas the feedback of other residents concerns the common areas of the building.

2.2 Focus of 2nd phase

The UI-related focus of Phase 2 is presented in this section. Thus, the UI features which should be developed during this phase are described, and the respective requirements are referenced. The sources of the second-phase requirements are the system analysis, recent workshops with pilot partners, D2.4 [2], which introduces several additional Use Cases (UCs), as well as D7.2 [4], which documents the revised pilot specifications.

2.2.1 Greece

In Phase 2, the UI should provide iFA end users with insights into energy efficiency (FN-UI-14) and sustainability metrics (FN-UI-10). More specifically, the users should be able to set goals relevant to the above concepts and receive customised alerts (FN-UI-15) on certain milestones of these goals, so that they can be assisted in achieving them. Furthermore, the users should be able to subscribe to an energy advising service, which will assist them in improving their energy performance via following customised advice per household (FN-UI-16).

The UI should be also equipped with a set of features presenting the various benefits that iFA end users gain via their iFAs. Hence, the users should be able to access through their UI the information retrieved from DR reports (FN-UI-13) with respect to their performance in explicit DR events, including the respective remuneration – economic or not. Moreover, the UI should provide the users with a visualisation of their energy tariffs (FN-UI-17), as well as an estimation of future energy costs for predefined periods (FN-UI-28). In addition to that, an estimation of the benefits gained from adopting iFA's suggestions should be presented to the users (FN-UI-29).

During the second phase, the users should also be able to provide the system with feedback on their experience while using the app (FN-UI-03). Furthermore, the interface should support – apart from English – the native language of pilot users, thus offering them an improved user experience (FN-UI-07). Moreover, an on-boarding wizard will assist the users during their first log-in by filling in some settings, based on their answers to a brief questionnaire (NF-UI-02), as can be seen in the Appendix (section 7.2.1). The users should also be able to view the actual schedules of their assets (FN-UI-27, see also Appendix (section 7.2.3)) and not only their schedule preferences – as was the case for the first version of the app.

The above functionalities are relevant to the UI for both the Greek and Slovenian pilots in Phase 2. However, due to the integration of the iFLEX web app into the existing Heron's mobile app in the Greek pilot, some additional requirements arise. First, this integration should be completed within Phase 2, securing interoperability between ICOM and Heron's solutions (NF-UI-01). Second, the Greek pilot users should be equipped with the ability to view their schedules even when offline (FN-UI-26), overcoming difficulties relevant to integration of the two UI solutions.

2.2.2 Slovenia

The described functionalities in the first paragraph of the previous sub-section for the Greek pilot should also be supported by the mobile application, which is deployed for the Slovenian pilot of iFLEX during the second phase.

2.2.3 Finland

In Phase 2, the focus is on extending the UI with improved user experience and new functionalities. More specifically, the UI design updates for the Finnish pilot restructure visualisation of measurement data and expand user feedback to a separate form. Here is a detailed summary:

- All residents can register directly using a "Signup"-form, but measurement data will be visible only after the administrator has edited correct "access-codes" for the user in the user database.
- All measurement values have now longer time range in charts. The user can select from six predefined time ranges: one day, one week, two weeks, one month, six months and thirteen months.
- In addition to temperature and humidity, the apartment charts include now also CO_2 measurement data.
- The CO_2 emission data are provided as a separate view.
- Electricity and district heating consumptions are available at the building level as separate views.
- The feedback is given from a separate view and includes now optional free text input and the option to set a referenced timestamp (for example: last Sunday at noon the apartment was too hot).
- Users will be provided with a view that shows results on the DR events executed at the building level. This functionality is still under development but will be ready before the pilots are deployed.

Phase 2 focuses also on a new interface targeted for the facility managers. The purpose of this interface is to visualise near real-time and historical measurements from the building for engineers managing the building.

2.3 Co-creation with end users

Co-creation with end users is considered to be an important aspect for the iFLEX project. Thus, several relevant activities have already taken place, while others are planned during the second phase. This section summarises the co-creation activities that pertain to the UI.

In Phase 1, the mock-ups of the applications developed for the Greek and Slovenian pilots have been shared with all the partners of the iFLEX consortium, so that initial feedback regarding the design could be retrieved.

This feedback was taken into consideration during the development of the prototype applications for the first phase. In the meantime, the recruitment of pilot users for Phase 1 started. Hence, the prototype applications for the Greek and Slovenian pilots were presented both to these users and to iFLEX partners during one-on-one interviews, so that feedback could be collected on the usability, design, and features of the prototypes. Their comments and suggestions were gathered in order to proceed accordingly to the second phase redesign, as well as to prioritise additional functionalities. For example, it was decided to introduce an on-boarding questionnaire, which will assist the users to set up their profiles upon their first log-in to the app. With respect to the Finnish pilot, user feedback on the indoor temperature is collected by the residents, so that it can be considered while responding to future DR events.

As regards the UI-related co-creation activities of the second phase, the mock-ups on additional functionalities or redesigned screens will be shared with users in order to receive their initial feedback prior to updating the application. Furthermore, workshops will be organised in the autumn of 2022, during which the pilot users will provide their feedback on the application. In addition to that, users will be able to submit their feedback through the application. The feedback gathered through these sources will be exploited for the final redesign of the application in the third phase.

3 Implementation

This chapter concerns the implementation for the Natural User Interfaces' task (T3.3), so the focus lies on the UI component. Hence, different architecture views are presented, as well as the updated UI design for the prototypes of Phase 1.

3.1 Context View

This section presents a high-level view of the UI component, presenting the functionalities that should be supported by the end of Phase 2. The iFA's UI is considered as a mobile or web application – depending on pilot specificities – that will provide the end users with the following functionalities:

- Monitor energy consumption/generation within premises (FN-UI-11, FN-UI-12);
- Choose desired level of automation by activating or deactivating auto mode (FN-UI-05), and by customising and activating scheduled and flexible operation modes - providing time and operational constraints (FN-UI-01, FN-UI-02);
- Select the objectives upon which energy optimisation of the premises will be based (FN-UI-04);
- Temporarily or permanently pause notifications (FN-UI-09);
- Receive DR event notifications (FN-UI-21) and provide acceptance for the iFLEX-proposed schedules concerning flexible assets (FN-UI-08);
- Receive DR reports (FN-UI-13), as well as access to DR participation history (FN-UI-22);
- Gain insights into energy efficiency (FN-UI-14) and sustainability metrics (FN-UI-10), and receive customised alerts on relevant goals (FN-UI-15);
- Subscribe to an energy advising service in order to receive tailored advice, which will assist in improving the energy performance (FN-UI-16);
- View energy tariffs (FN-UI-17), as well as an estimation of future energy costs (FN-UI-28);
- View an estimation of the gained benefits from adopting iFA's suggestions (FN-UI-29);
- View the actual schedules of assets online (FN-UI-27) and offline (FN-UI-26);
- Provide feedback (FN-UI-03) on the experience while using the app or on their comfort level;
- Choose the system interface language between English and native language (FN-UI-07);
- Get profiles automatically filled in by an on-boarding wizard during the first log-in on the app, based on answers to a brief questionnaire (NF-UI-02).

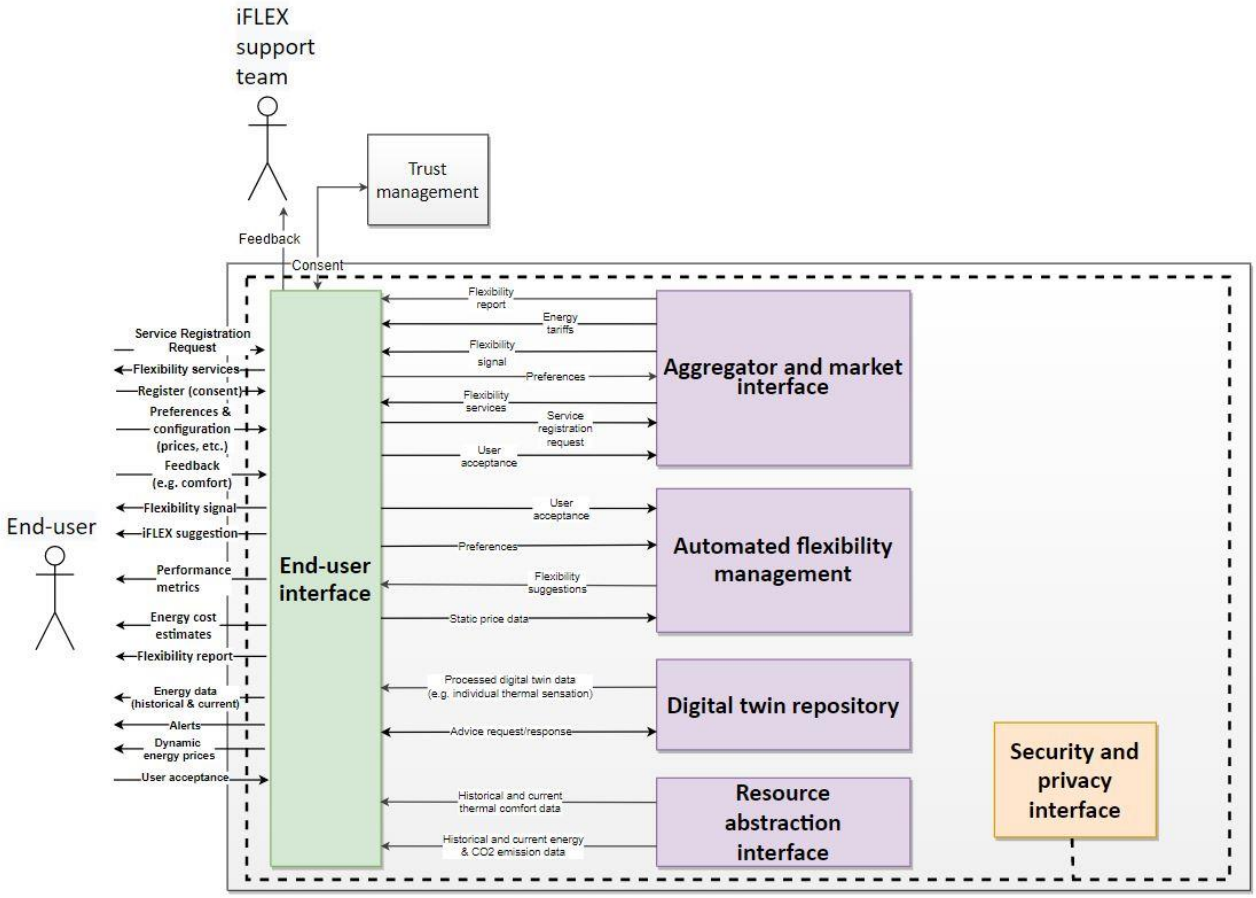

Figure 1: Context view of the UI module

Towards this, the UI component will need to communicate with the various components of the iFA Framework:

- Aggregator and Market Interface (A&M Interface): The information flows with the A&M Interface concern DR-related signals, such as receiving information on available flexibility services, flexibility signals and flexibility reports, and responding to flexibility signals or subscribing to a new flexibility service. In addition to that, energy tariffs are communicated to the iFA end user via the UI module.
- Automated Flexibility Management (AFM): The AFM module receives from the UI the user preferences with respect to the operation of flexible assets. Furthermore, the iFLEX-suggested schedules are communicated from the AFM to the UI module, which in turn provides the AFM with the user's response to a suggestion. Finally, the users might be able to add their energy tariffs in iFA via the UI, and inform the AFM about them – depending on the specificities of each pilot.
- Digital Twin Repository (DTR): As regards the interaction of the UI component with the DTR, processed data (e.g., with respect to individual thermal sensation) and signals related to the energy advising service of the Assistant shall be exchanged.
- Resource Abstraction Interface (RAI): The UI module should be able to receive real-time and historic energy, CO_2 emission, and thermal comfort data from the RAI.

Figure 1 presents the interactions of the UI component with its environment, namely the iFA end user and other components of the iFA. It is highlighted that this context concerns the full lifecycle of the iFLEX project.

3.2 Functional View

The main components of iFA's UI module for the three different instantiations are documented in this section.

3.2.1 Mobile application for residential end users

This section presents the functional view of the UI in the Slovenian pilot (Figure 2). The frontend sub-components are the following:

- Admin Web Client: Intended to be used by site administrators – not by the actual users of the iFA. It is utilised during the development process to facilitate data testing, but can also be exploited in order to manage data in production.
- iFA Mobile Client: iFA's UI is built as a native mobile application. This application includes also a Local Database, in which all the data relevant to the specific user are stored.

As regards the backend, the utilised sub-components are as follows:

- End User Personalised Services: This sub-component equips the iFA end user with the ability to retrieve personalised data, such as asset schedules, objectives, past DR events, and notifications.
- Real-time Services: This sub-component enables receiving real-time in-app notifications.
- (Push) Notification Service: This sub-component is charged with generating and communicating push notifications to iFA end users.
- Reverse Proxy/Load Balancer: This server is responsible for securing communications, as well as load balancing and proper domain name matching.
- Cron Jobs: This sub-component handles the scheduling and execution of periodic tasks.
- Channels/Tasks Cache: This sub-component is responsible for the temporal caching of data from the other sub-components of the UI's backend.
- Remote Database: The remote database ensures data persistence for all the backend data.

Finally, it is highlighted that the UI's backend needs to communicate with the backend of other iFA components (e.g., to receive an iFA-generated schedule suggestion, to send user's schedule preferences, etc.).

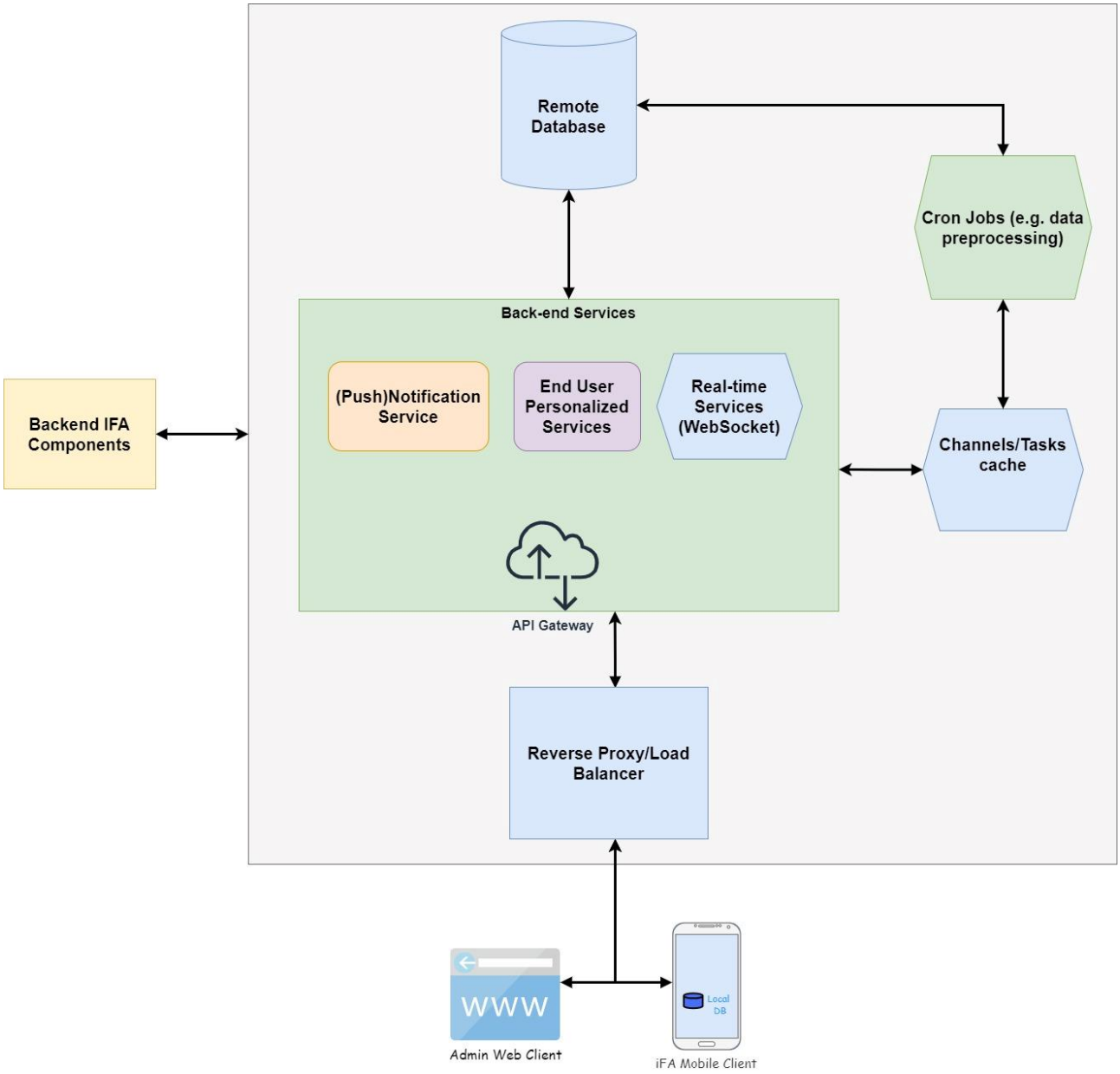

Figure 2: Functional view of the mobile app's UI component for residential end users

3.2.2 Web application for residential end users

This section concerns the functional view of the UI in the Greek pilot of the project (Figure 3), which is exposed as a web view through Heron's mobile app. As many sub-components are identical in both the Greek and Slovenian pilots, this section focuses only on their differences. As regards the frontend sub-components:

- iFA Web Client: iFA's UI is accessible via this web client – either as a web view in the existing Heron mobile app or alternatively via a web browser.
- Heron Mobile App: The mobile app, which is developed by Heron for its customers. Additional functionalities, which are relevant to iFLEX, are exposed to the users via the iFA web client.

As concerns the backend, some functionalities are not part of the iFA's UI backend. More specifically, the (push) notification service sub-component is hosted instead by Heron's UI backend. Furthermore, an authentication and authorisation server, which is developed by a third party and provided by Heron, is exploited, whereas in the Slovenian pilot this service is hosted in the iFA's UI backend. Hence, the UI backend should also interact with these external sub-components.

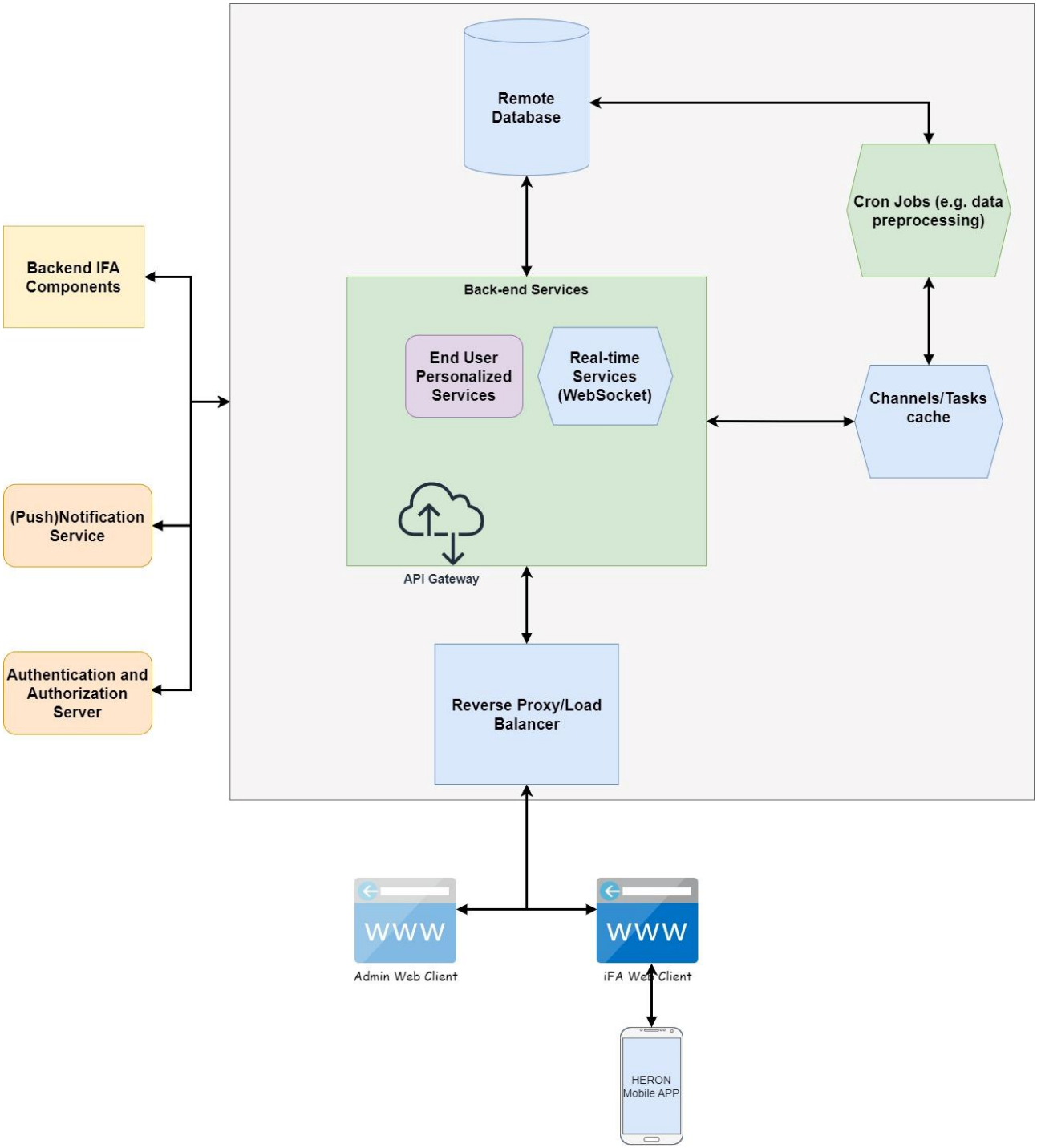

Figure 3: Functional view of the web app's UI component for residential end users

3.2.3 Building community

In the Finnish pilot, two types of users can be identified: residents and facility managers. For facility managers, we provide a UI created using Grafana [5], which is a multi-platform open-source analytics and interactive visualisation web application. For residents, a custom UI is built using standard and open-source web application techniques. The main components are illustrated in Figure 4.

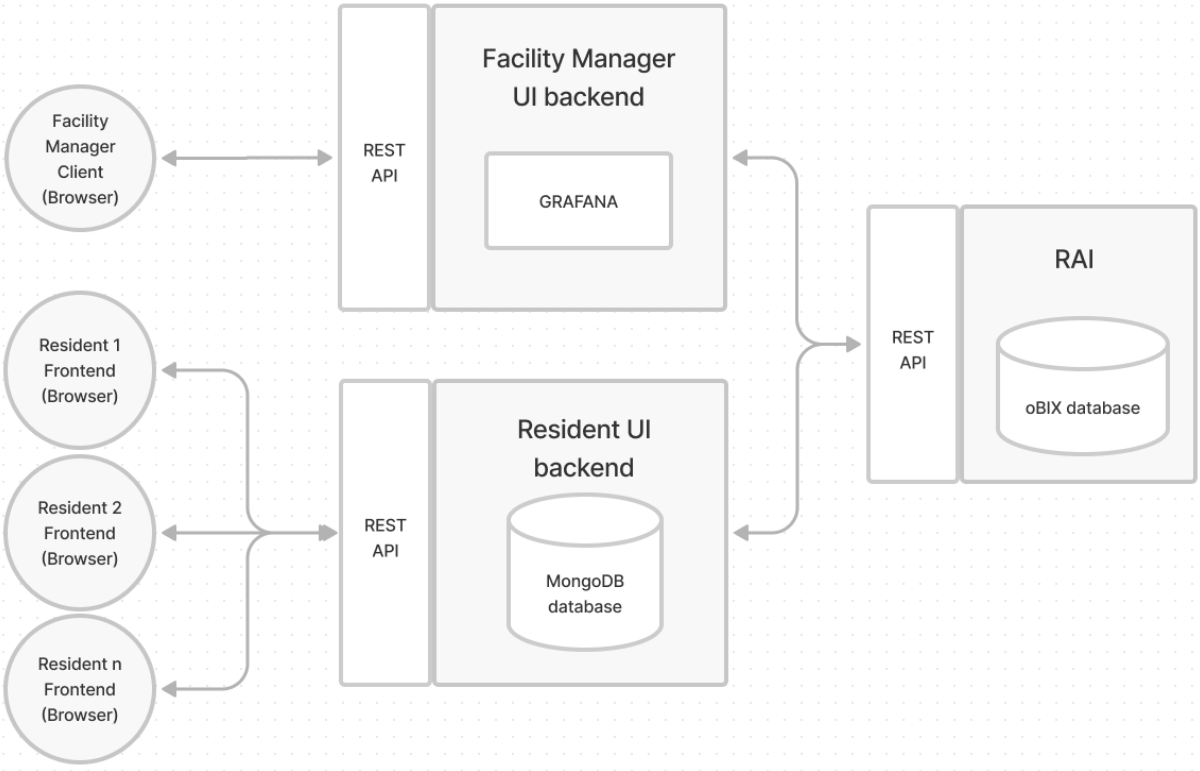

Figure 4: Functional architecture of the UI for the building community

3.3 User Interface Design Updates

This section presents the up-to-date progress regarding the UI Design of the iFA. First, the solution for individual end users is exhibited. Then, the work on the UI of the building community is shown.

3.3.1 Mobile application for residential end users

The Slovenian pilot's case, which is operated by ECE, is presented in this section. The work presented is based on the implemented solution of the 1st phase, complemented with the design updates or relevant placeholder for the features of the 2nd phase, where appropriate.

3.3.1.1 App Initiation

In order to acquire access privileges and be able to navigate to all application pages, the user needs to log in using personal credentials as presented in Figure 5.

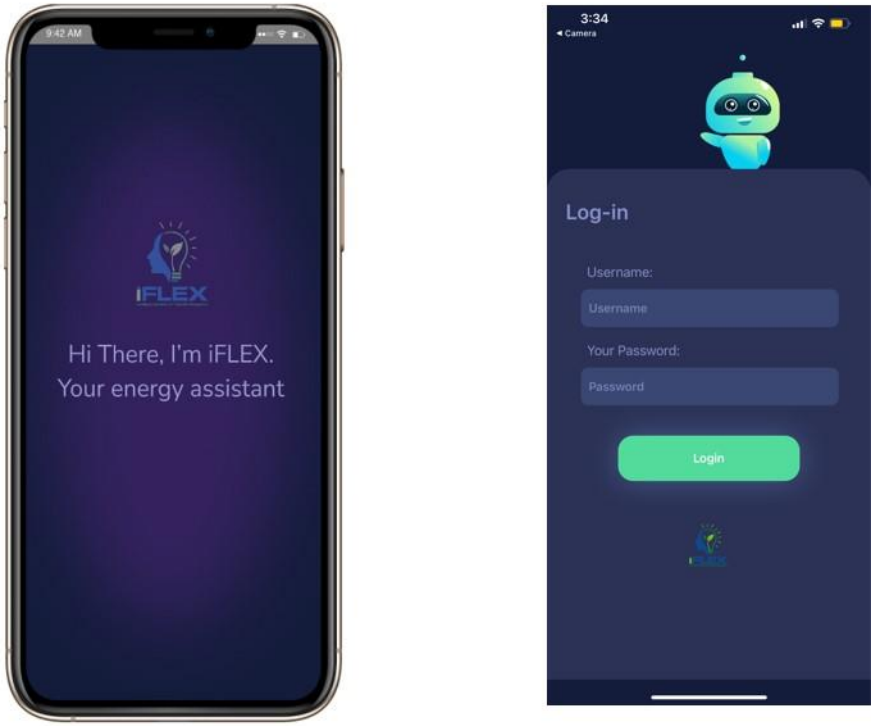

Figure 5: Mobile app – Splash and log-in screens

After the user successfully logs into the application, the landing screen is the “Energy” screen (Figure 6). In the main menu, which can be found in the lowest part of every screen, the options “DR Events”, “Advice”, “Energy”, “Costs” and “Settings” are available. In the navigation bar at the top of the screen, there is a back button, the notifications and the user profile.

In the “Energy” screen, users are able to access information on their energy data and they can also set the exact period of time for which they would like to retrieve their data. Additionally, one has the option to select the desired time resolution, for example, data per day, per week etc. Below, there are cards with various metrics for the user’s selected time period. There is also a graph with the lines in different colours and the legend at the bottom, which describes each colour’s functionality. On the right of the asset’s name there is an “eye”. By selecting it, the user can hide data from the graph, so that they can focus on the consumption of specific assets for the desired time period. In the 2nd phase, the users will be also equipped with the ability to see the upcoming schedules of their flexible assets through the “Energy” screen.

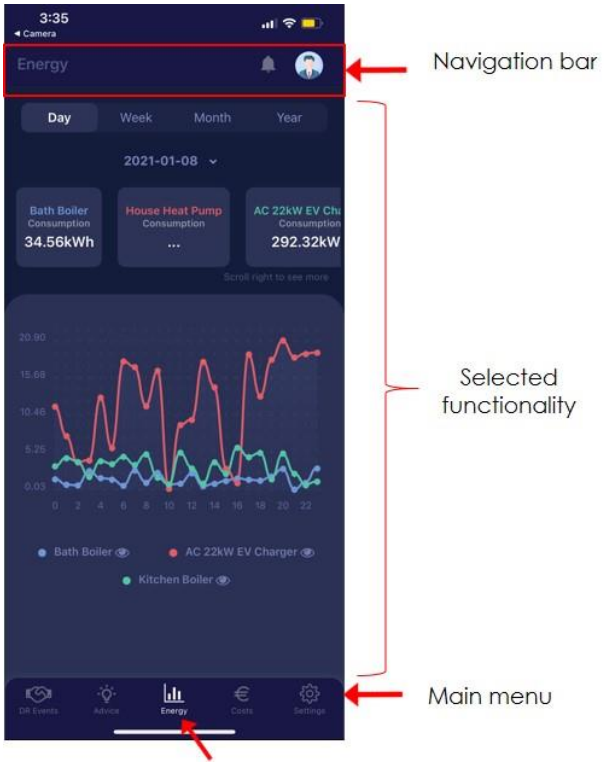

Figure 6: Mobile app – "Energy" screen

3.3.1.2 Settings

In the main menu found at the lowest part of the screen, when selecting the fifth option which is called “Settings”, users are directed to the screen shown in Figure 7. In this screen, users are able to access the settings menu. In the settings menu, options such as “Preferences”, “Push Notifications” and “Goals List” can be accessed. In the “Preferences” option, there is a sub-menu with the options “My Objectives” and “My Schedules”. Respectively, in the “Push Notifications” option, there are two sub-options “Silence Rules” and “Temporary Silence”.

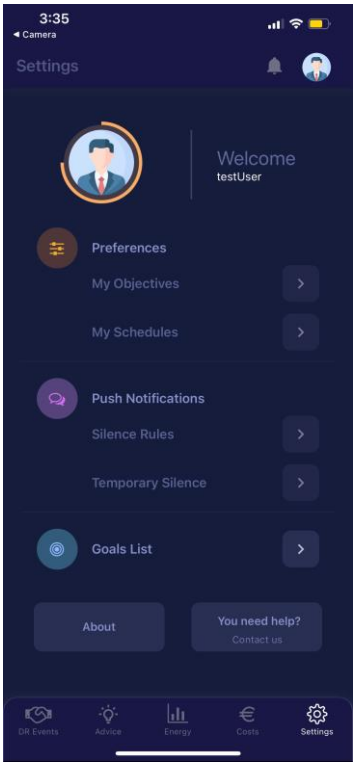

Figure 7: Mobile app – “Settings” screen

Selecting the first option “My Objectives”, users are directed to a screen where they can select their optimisation policy. This screen is designed with the thought that users will have the possibility to select many policies at the same time. This way, the iFLEX Assistant will make decisions while trying to accomplish the user’s objectives. The relevant screens can be seen in Figure 8.

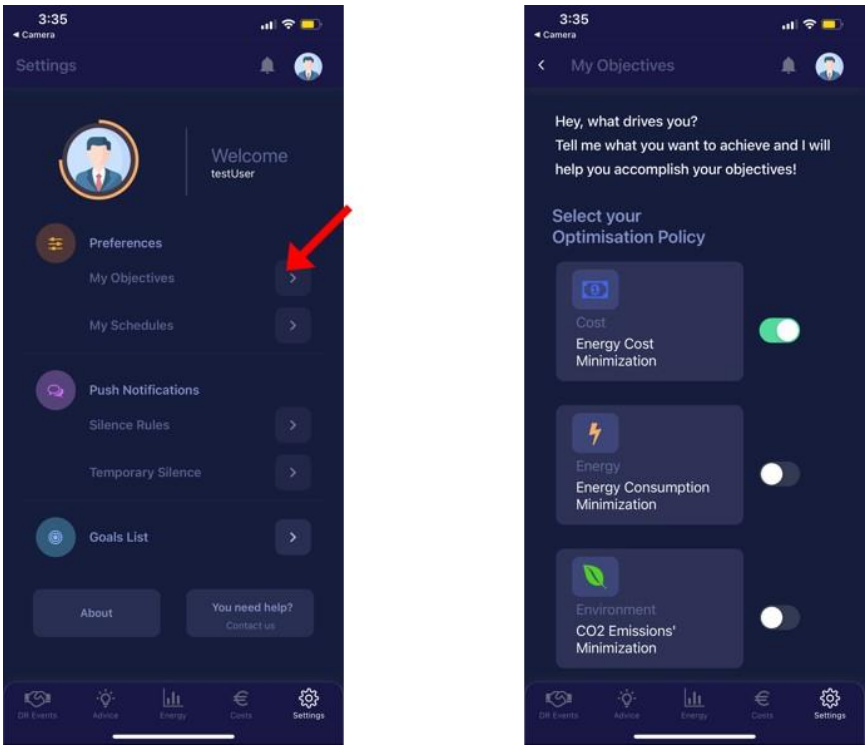

Figure 8: Mobile app – “My Objectives” screen

Back to settings, when selecting the second option called “My Schedules”, users can find all the schedules they have set, as shown in Figure 9. At the top of the screen there is the button “Add new schedule”. Below this button, users can find all the saved schedules. The users set the desired schedule per asset and are equipped with the ability to group the guidelines for more than one asset under an operation mode. This way, they can control multiple assets defining a single operation mode and save the mode in case they want to activate it again. For each saved operation mode, information such as the days of the week that this mode is activated, the assets, the name of the operation, etc. can be found. The users are also able to edit each saved operation mode, delete it, activate it or deactivate it.

In case users would like to add a new operation mode, they will have to select the button “Add new Schedule” which is going to lead them to a form. Users have to give a title for the new operation and define the days for the specific operation. Next, the users must select an asset from a list and give specific details about the desired operation of the asset and the specific hours. There is also a check box asking the users if they want to make the operation flexible. When the users choose to make the operation of an asset flexible, the time fields do not represent the exact hours that the asset will operate. Instead, they represent an available time slot within which, the asset will work for a specific duration set by the users. Depending on the asset’s characteristics, through a flexible operation mode it might also be possible to define a range of acceptable operation instead of an exact operation point. For example, this could be applied to the temperature limits of a heat pump. When all the fields are filled, users select “Set Schedule” and the operation mode is saved and activated.

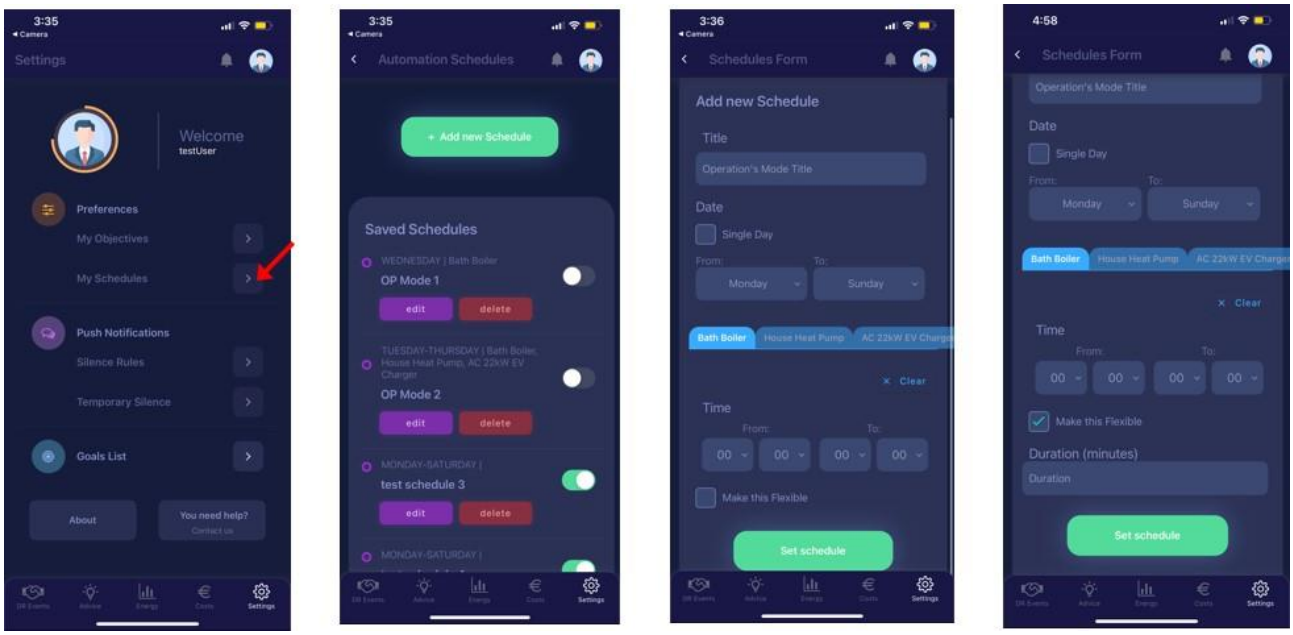

Figure 9: Mobile app – “My Schedules” screens

Heading back to the general settings menu, when selecting the third option called “Silence Rules”, the saved silence rules are displayed (Figure 10). A silence rule includes a silent period during which the user will not receive any push notifications. If users want to add a new silence rule, they will have to fill in two fields; one for the days and the other for the hours that the silent period will be activated. When all the fields are filled, the user selects “Set silent period” and the silent period is saved and activated.

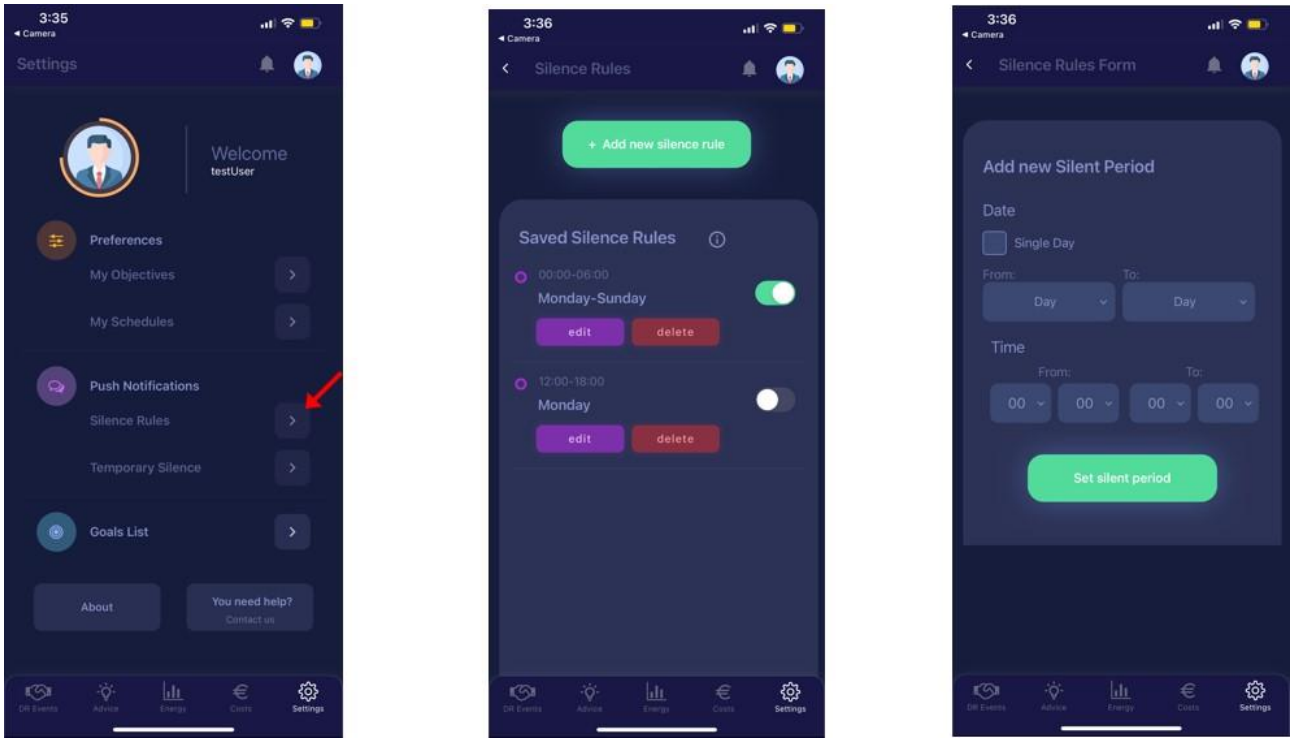

Figure 10: Mobile app – "Silence Rules" screens

Back to settings, when selecting the fourth option called "Temporary Silence", users can mute temporarily all the push notifications, as shown in Figure 11. Push notifications are messages that pop up on a mobile device. iFA can send them at any time; users don't have to be in the app or using their devices to receive them. Such notifications are used to convey information about new DR events, to notify about alerts, etc.

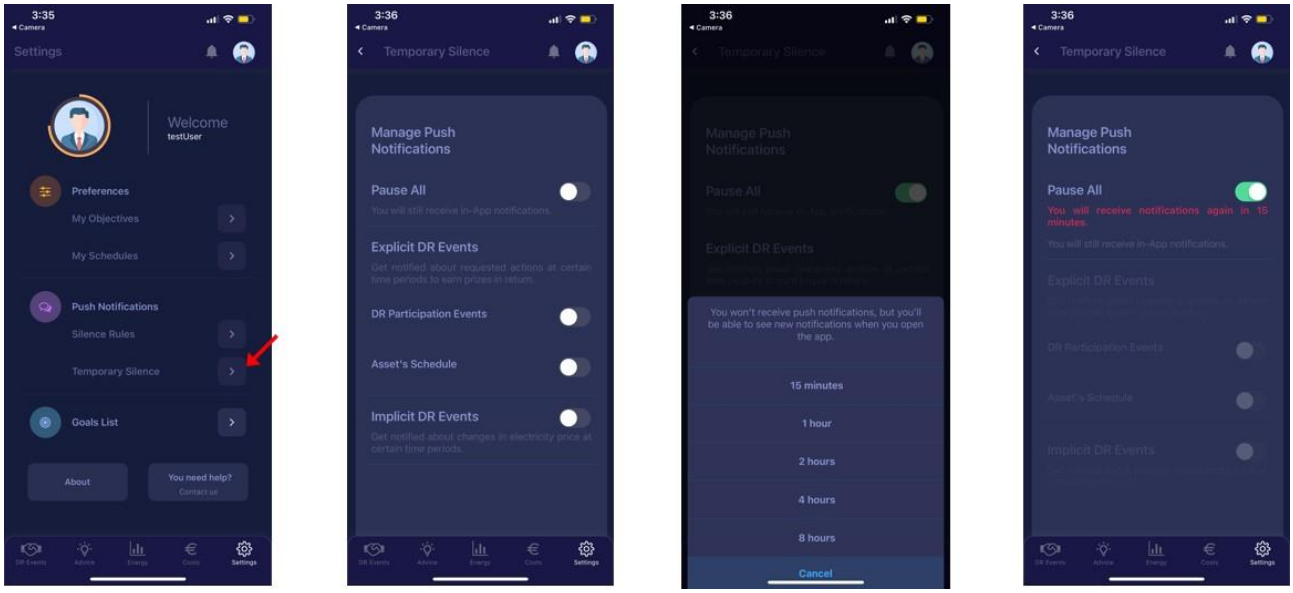

Figure 11: Mobile app – "Temporary Silence" screens

Heading back to the general settings menu, when selecting the last option called "Goals List" a "Coming Soon" screen appears (Figure 12), since this functionality was not planned for the 1st phase.

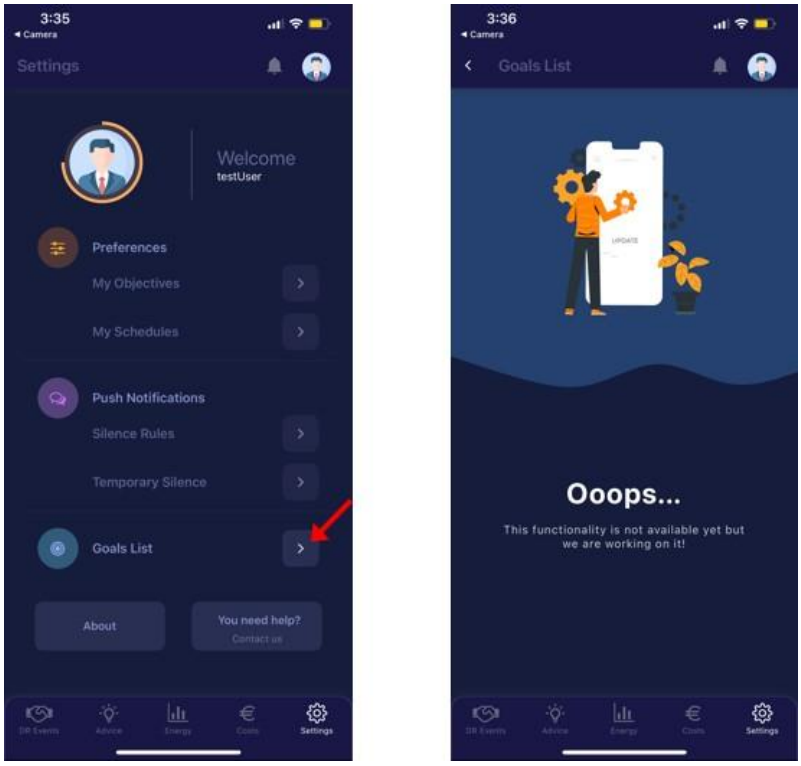

Figure 12: Mobile app – "Goals List" screen

In the lower part of the General Settings screen, the user can find general information and a help centre. These screens are shown in Figure 13. While navigating through the mobile app, the selected functionality is displayed based on the user's choice among the options in the main menu or navigation bar.

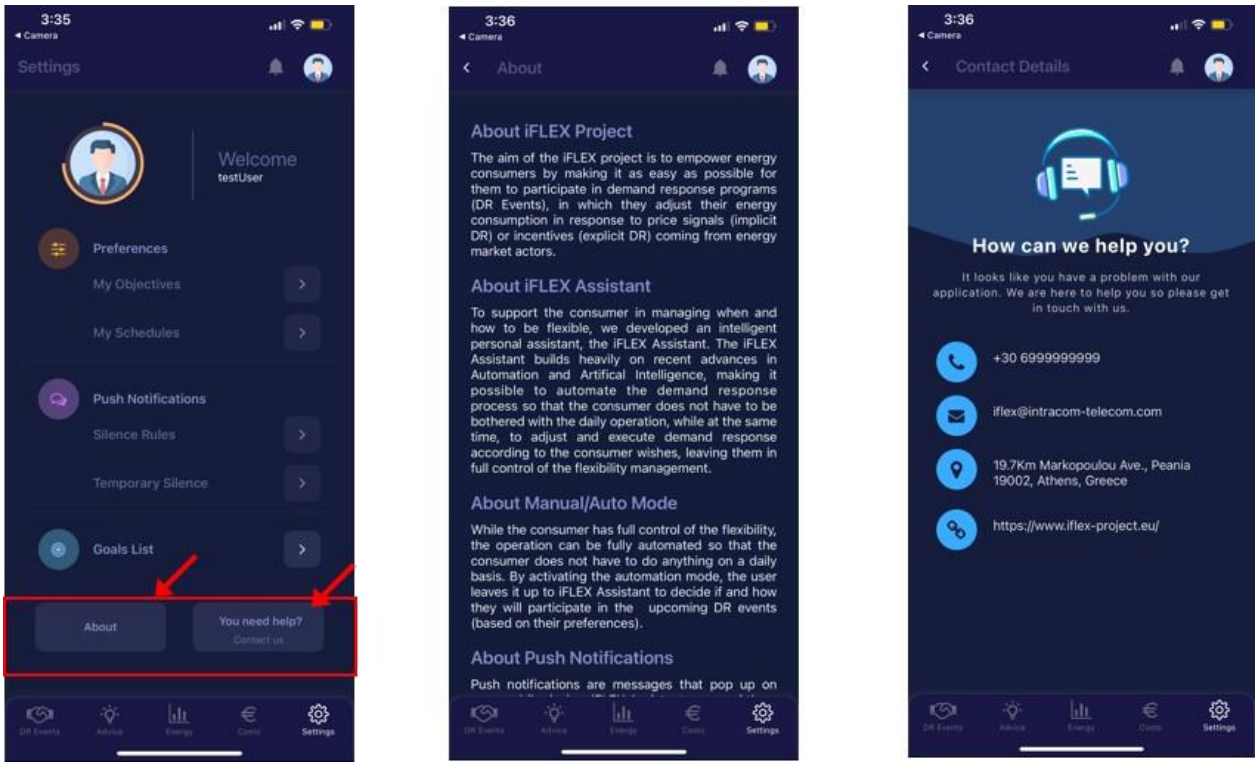

Figure 13: Mobile app – General Information and Help Centre screens

3.3.1.3 DR Participation

In the main menu, which is found at the lowest part of the screen, when selecting the first option which is called “DR Events”, users are directed to the screen shown in Figure 14, where they can check their DR participation history and details about each event. In addition, the user is informed about the action taken in order to participate in the specific DR event and whether the decision to participate was made automatically (i.e., from iFA) or manually. Users can see not only the DR events in which they have participated in the past, but also those which they have rejected. At the top of this screen, users can see the total points earned through participation in DR events. Here, an approach based on a reward mechanism is presented, so that users can gain a reward once they have reached a specific number of points. Based on this, there is a bar informing the users of the remaining points to be earned until the next reward.

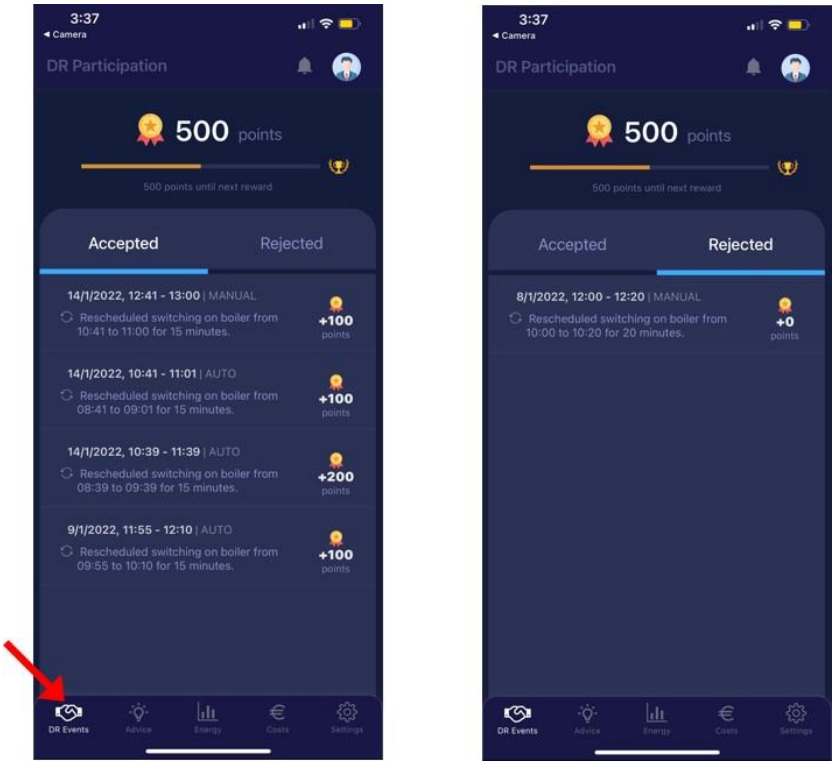

Figure 14: Mobile app – “DR Events” screens

3.3.1.4 Auto Mode

In the menu found at the top of the screen, when selecting the “user” icon, users are directed to the screen shown in Figure 15 where they can manage their profile settings. When the “Auto Mode” is off, the user has full control of the energy and flexibility management. When the “Auto Mode” is on, the operation of iFA is fully automated and the user does not have to do anything on a daily basis. Any actions taken by the iFA will be communicated to the user via app notifications.

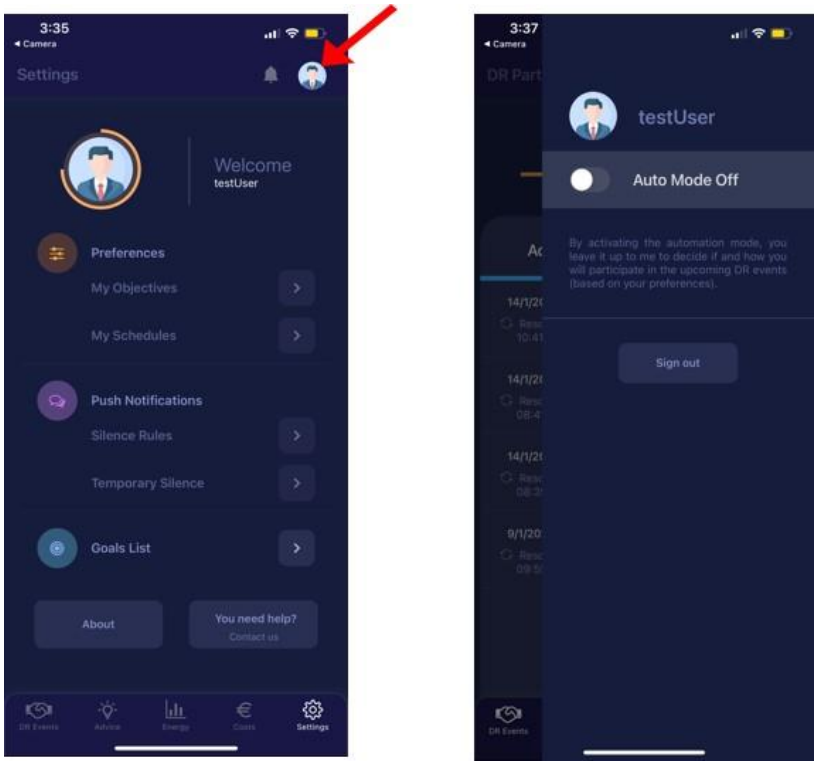

Figure 15: Mobile app – Activation of Auto Mode

3.3.1.5 Notifications

In the menu found at the top of the screen, when selecting the bell icon, users are directed to the screen shown in Figure 16, where they can check their various notifications. For example, when receiving a notification about an explicit DR event, this means that the users have to change their consumption accordingly in order to participate in that DR event. The users are notified of an upcoming DR event and are prompted to accept or reject it. After checking the date and time of the event, the users decide whether or not to participate in it.

If a user accepts a previous notification about participating in an explicit DR event, the iFA proposes after some time a rescheduling of a flexible asset, so that the user can participate in the upcoming DR event. In case the user rejects the suggested action, the iFA is trying to find another suggestion. Upon reaching the maximum number of rejections, the user is notified that participation in the DR event is cancelled, as iFLEX failed to find an acceptable solution.

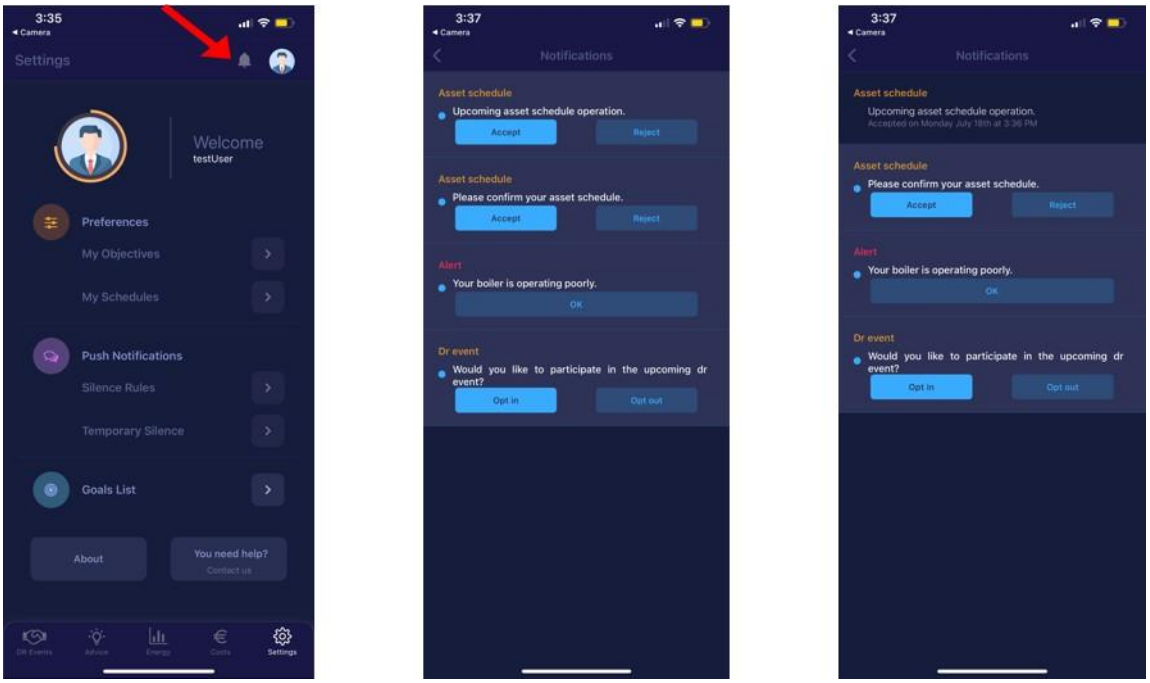

Figure 16: Mobile app – "Notifications" screens

It is noted that certain functionalities of the iFA such as advice, alerts, and cost monitoring will be developed in the second phase of the iFLEX project. Hence, when the user selected these options the following screens (Figure 17) appeared.

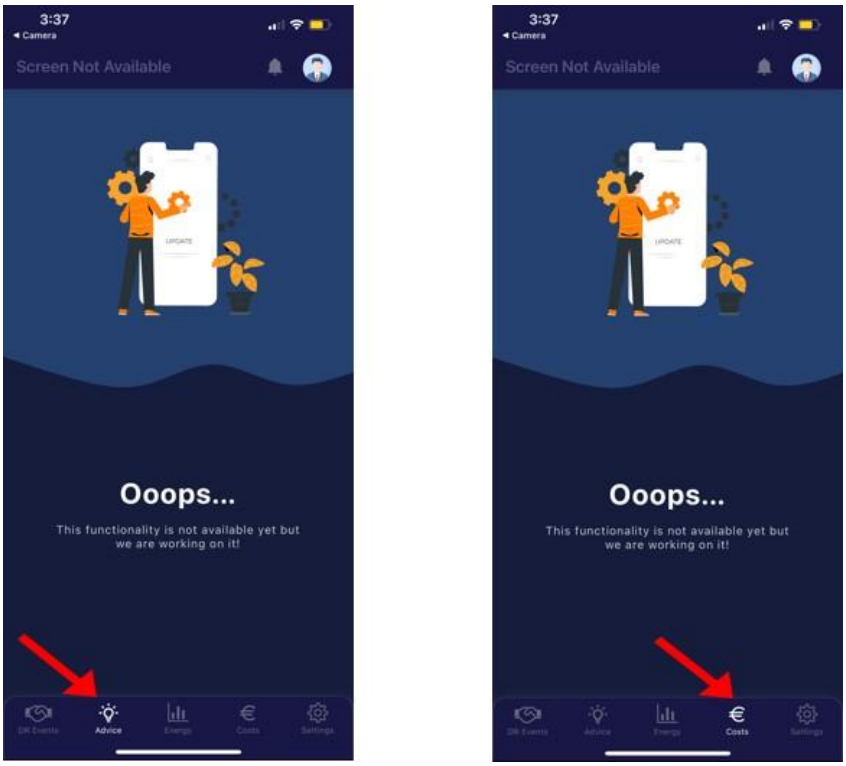

Figure 17: Mobile app – Future features

3.3.2 Web application for residential end users

The Greek pilot's case, which is operated by Heron, is presented in this section. As the functionalities supported by the web app are also described in the section concerning the mobile app (3.3.1), more details

on the various features can be found there. The scope of the current section is to show the UI design of the web app and the navigation within it.

3.3.2.1 App Initiation

The user initially interacts with Heron's mobile application and can be swiftly redirected to iFA's web application, which supports the additional iFLEX-based functionalities, via selecting the relevant button at the bottom right of the screen (Figure 18). Thus, increased user experience is secured, as the pilot users can continue using the same application that they have become accustomed to. It is also noted that the UI design of iFA's web app is tailored to the design of Heron's mobile app, so that the user experience is further improved through recognition thanks to the common design adopted by both applications.

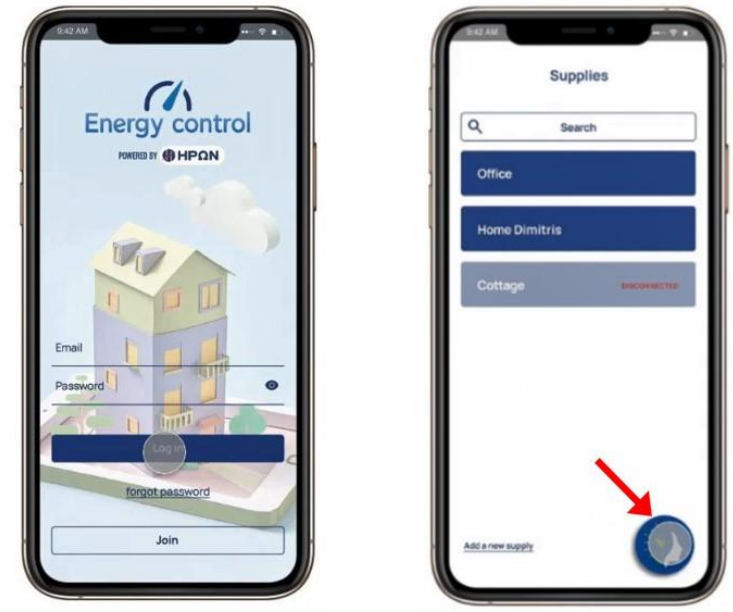

Figure 18: Heron's mobile app – Log-in screen and redirection to iFA's web app

3.3.2.2 Settings

Once the users have logged in to iFA's web app, they can access and modify their optimisation objectives by selecting "Settings" and subsequently "Preferences", as shown in Figure 19.

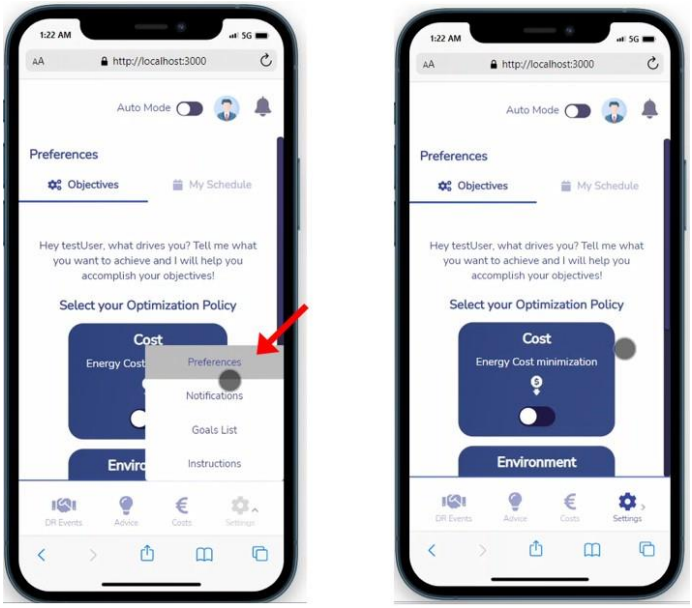

Figure 19: Web app – "My Objectives" screen

By clicking on the right tab of the “Preferences” page, namely “My Schedules”, the users can add, edit, delete, activate or deactivate operation modes according to their wishes, as described in Figure 20.

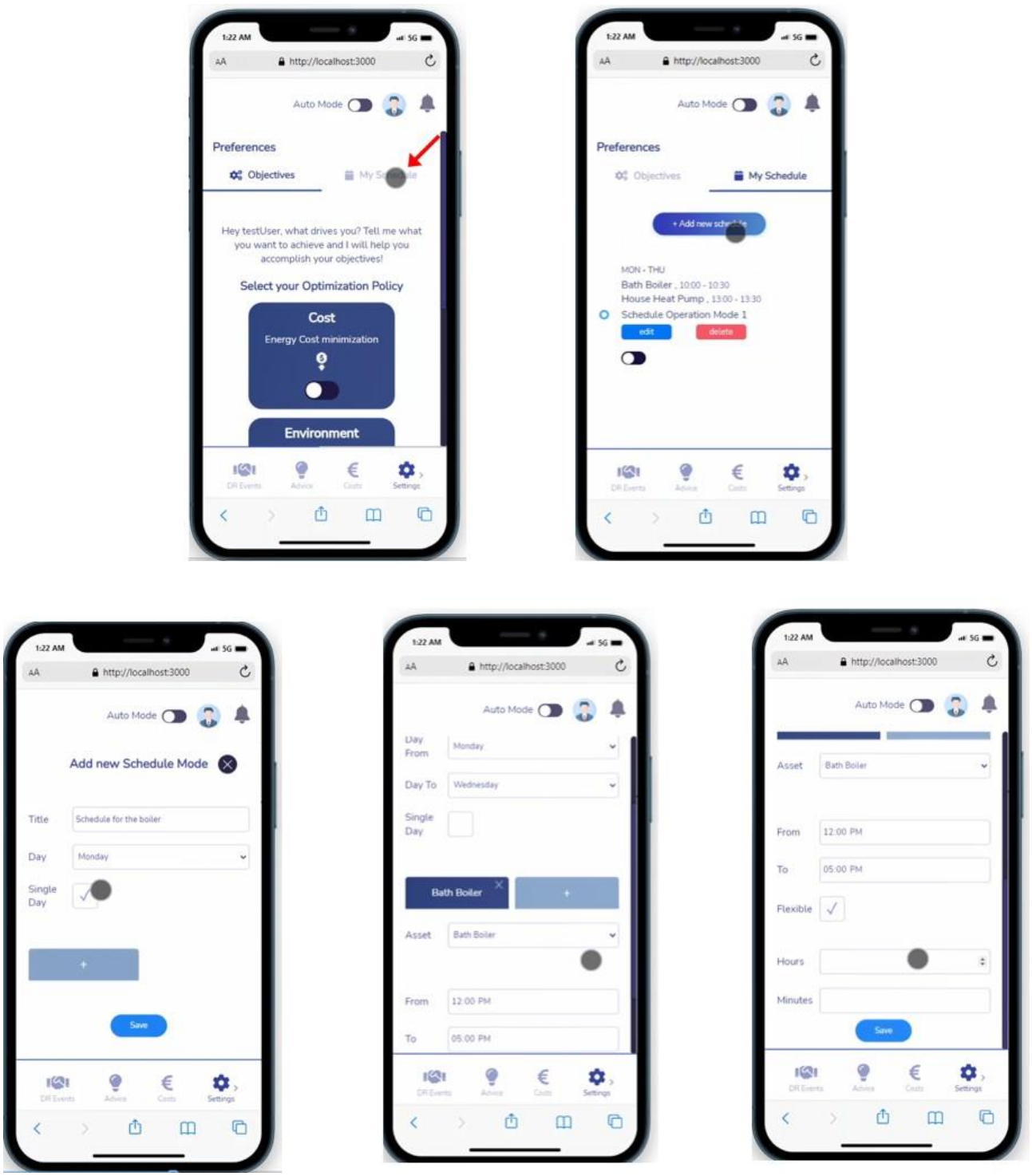

Figure 20: Web app – “My Schedules” screens

Upon selecting “Settings” and then “Notifications”, iFA end users can add, edit, delete, activate or deactivate silence rules, so that they do not receive push notifications during their selected time periods. The relevant UI design is exposed in Figure 21.

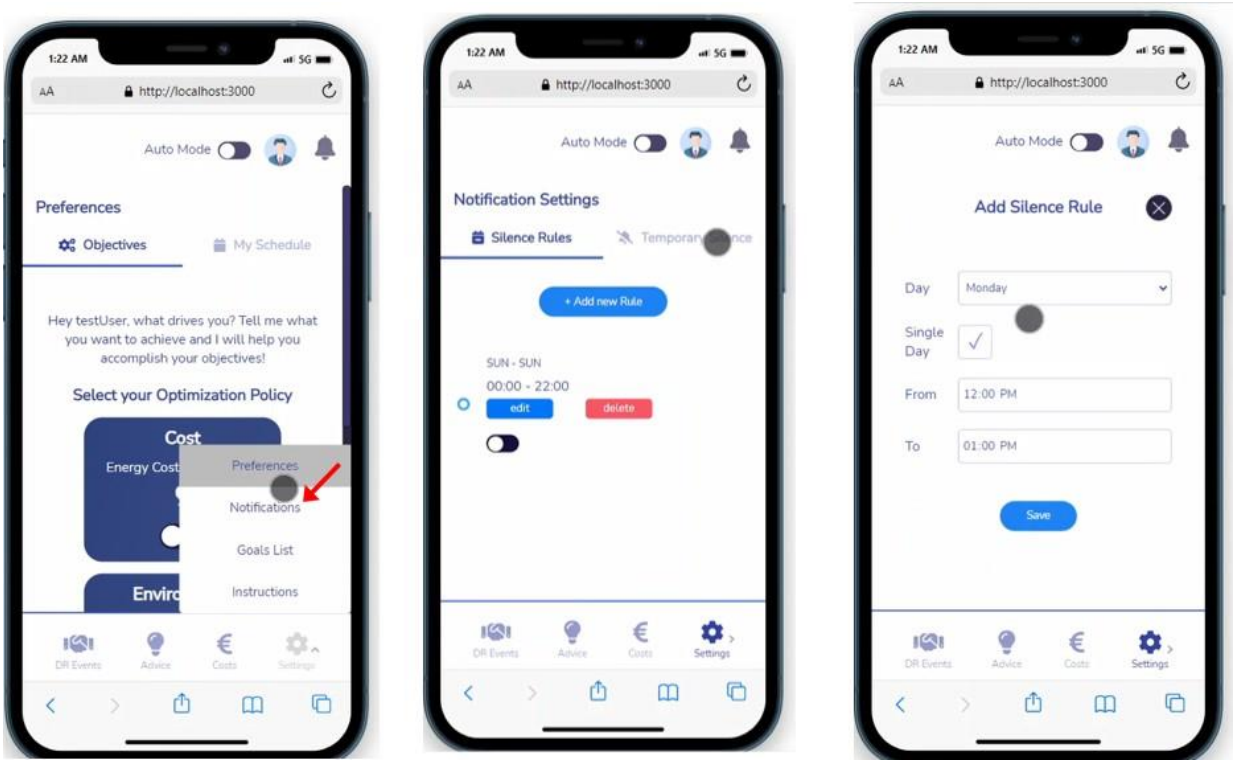

Figure 21: Web app – “Silence Rules” screens

If the users click on the right tab of the “Notification Settings” page, they access the “Temporary Silence” page, which enables them to temporarily pause push notifications for the time period of their choice. The relevant procedure is shown in Figure 22.

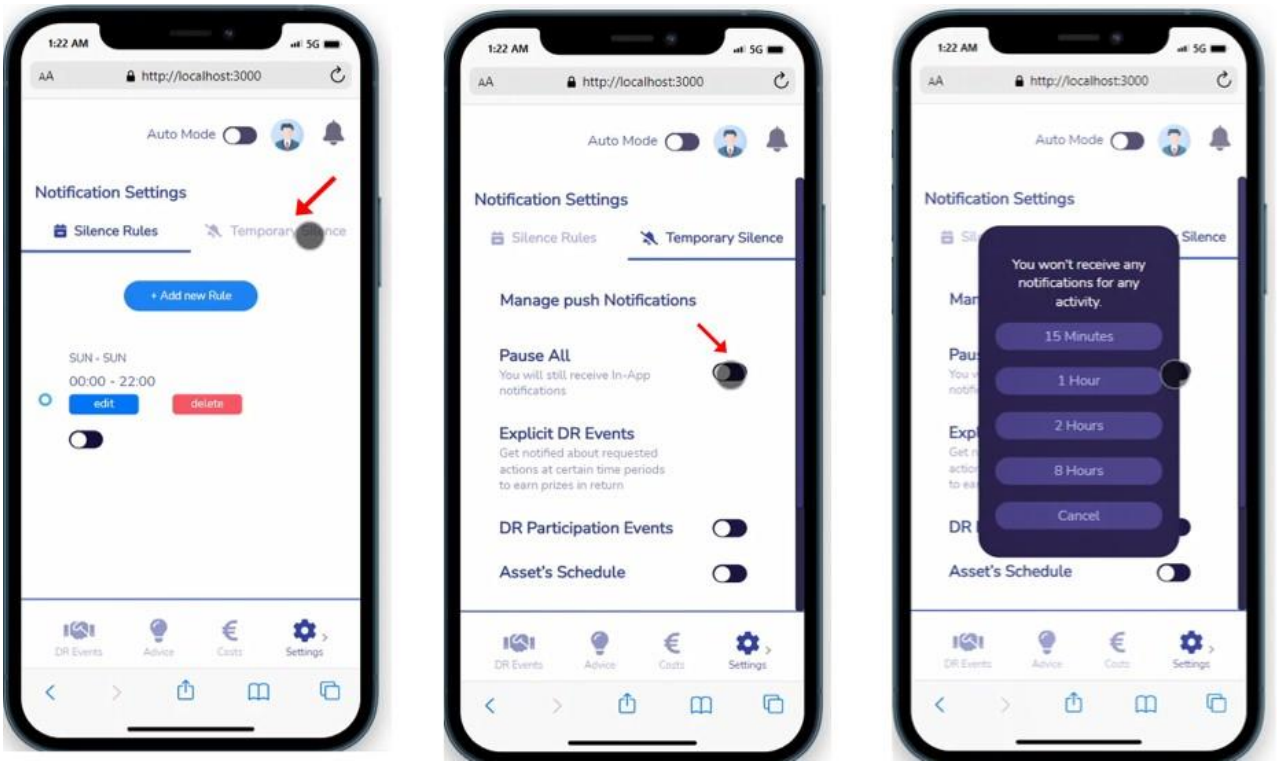

Figure 22: Web app – “Temporary Silence” screens

3.3.2.3 DR Participation

The users are also able to access their DR participation history, including both accepted and rejected DR events, by selecting “DR Events” at the bottom left of the screen. The relevant screens are shown in Figure 23.

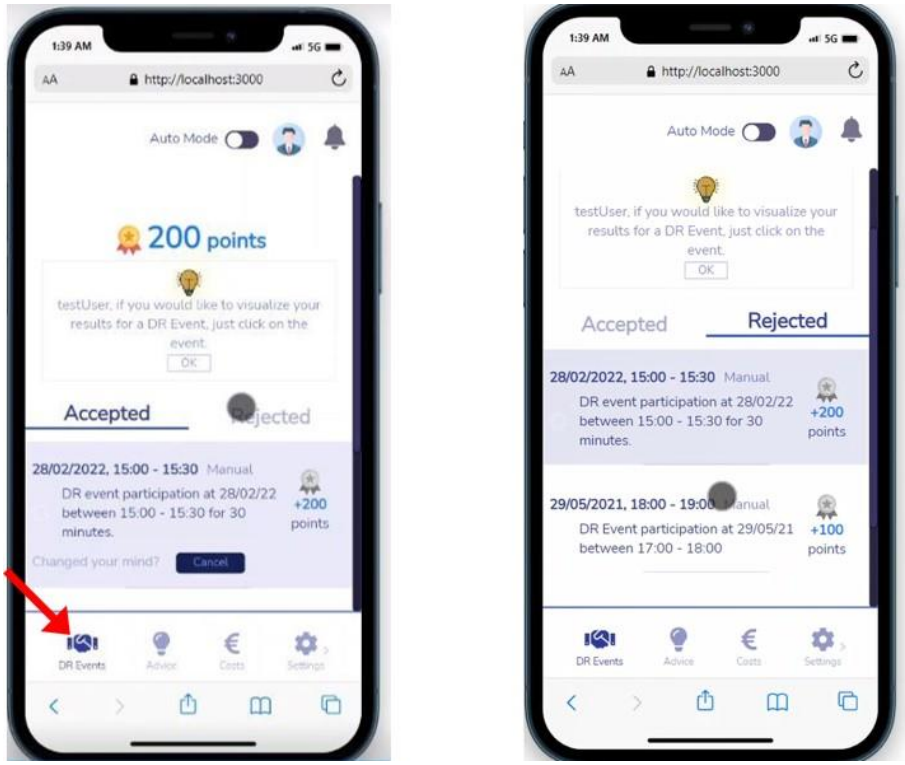

Figure 23: Web app – “DR Events” screens

3.3.2.4 Auto Mode

iFA end users can switch between auto and manual mode for their Assistant through the toggle button “Auto Mode”, which can be found at the top of the screen, as indicated in Figure 24.

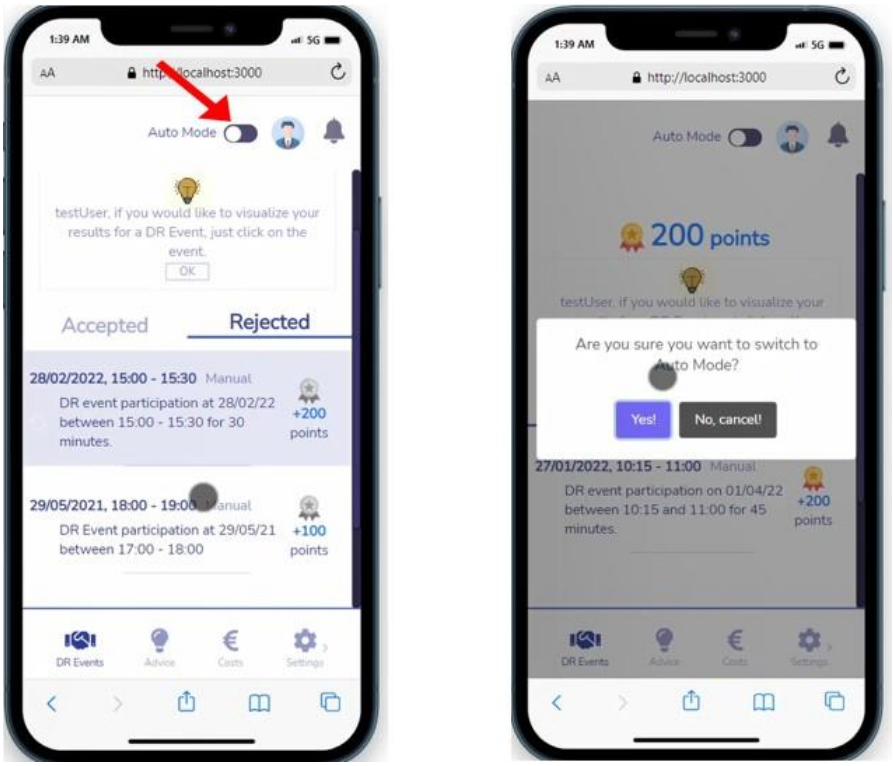

Figure 24: Web app – Activation of Auto Mode

3.3.2.5 Notifications

Users can access their notifications by clicking on the bell icon at the top right of the screen, as shown in Figure 25. The first two sub-figures concern notifications on a new DR event and a new iFA-suggested asset schedule, while manual mode is activated. On the contrary, the right sub-figure presents a notification on an iFA-generated schedule for the purpose of participating in a DR event, while auto mode is enabled.

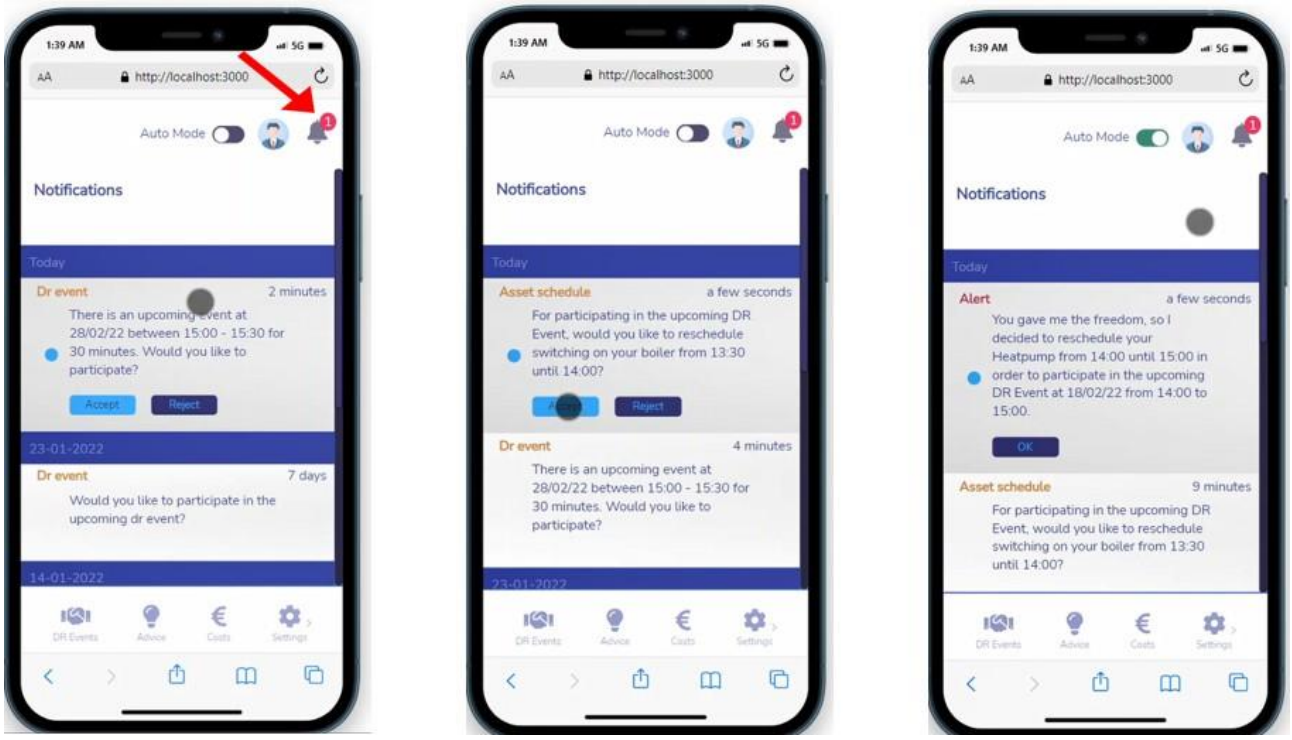

Figure 25: Web app – “Notifications” screens

3.3.3 Building community

3.3.3.1 Resident Interface

The Finnish pilot's UI displays information about building data to all residents, also to unauthenticated users. If you are a registered user and have sensors in your apartment, you can log in and see apartment temperature, humidity and CO_2 levels for different periods of time. All residents can give feedback about building temperature and registered users can give additional feedback about apartment temperature. Free text feedback can also be given. The navigation map illustrates navigation paths (Figure 26), whereas more detailed screenshots can be found below.

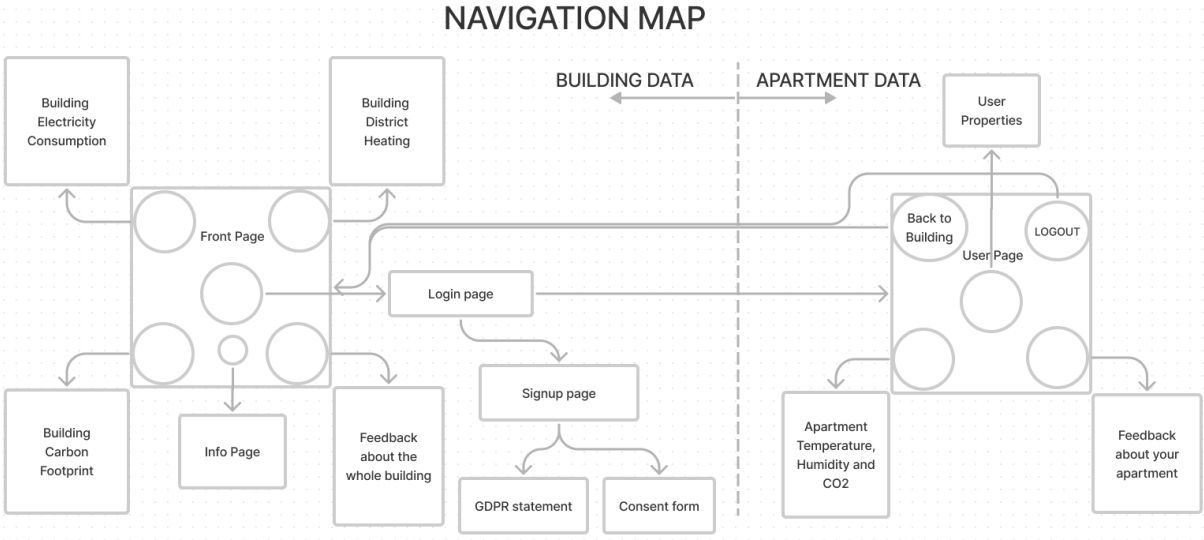

Figure 26: The navigation map of user interface

The main front page displays buttons to access building information: top left button opens building electricity consumption page, and top right button opens building district heating page (Figure 27). The time range for displayed measurement values can be selected using six predefined time range buttons on top of the chart: one day, one week, two weeks, one month, six months and thirteen months.

Figure 27: The Front Page: Building Electricity and District Heating

Bottom left button (the leaf) opens a display of the building's CO_2 carbon footprint (Figure 28). It is calculated as a sum of electricity and district heating emissions from the building. The upper chart displays values per resident, where building values are divided by number of residents. The lower chart displays total emissions of the building at any given time. A small info-button opens the info page, where a short description about

iFLEX user interface is shown. The button on the bottom right opens a feedback page (Figure 28), where the user can send feedback about building temperature using 7-scale emoji-icons. The scale goes from: “Cold”, “Cool”, “Slightly Cool”, “Happy”, “Slightly Warm”, “Warm” to “Hot”. Additional free text input can be entered and if the feedback is about some specific date and time (for example: last Sunday in the morning it was too cold), there is a separate timestamp which can be adjusted from calendar and time components.

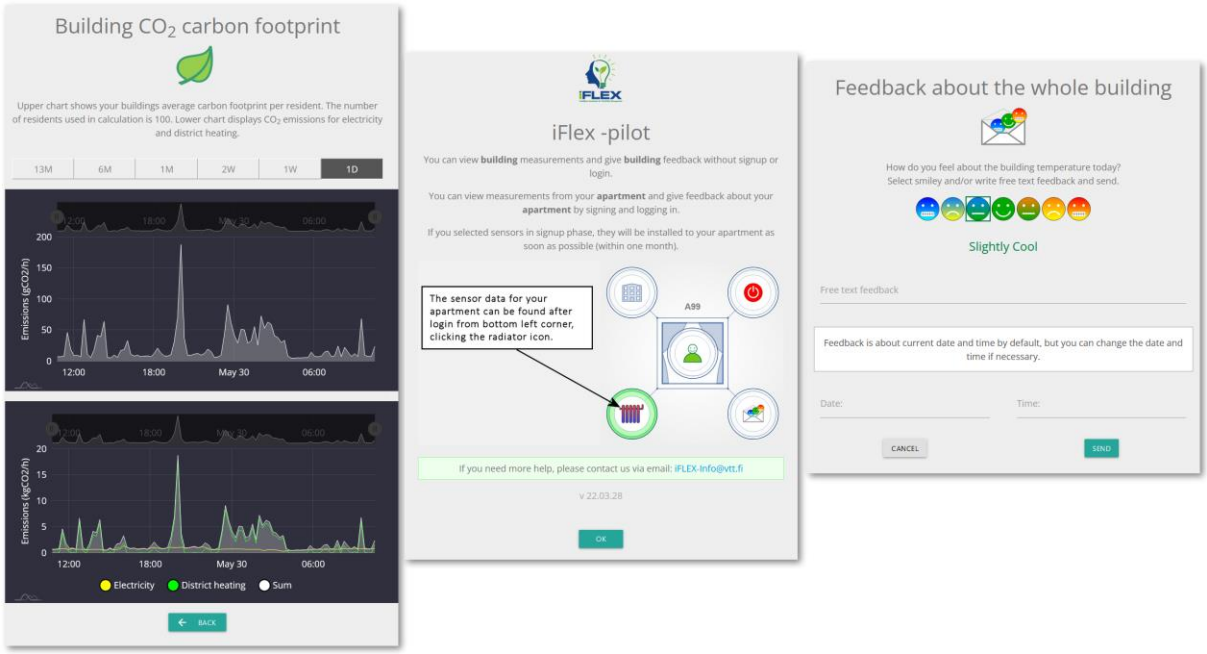

Figure 28: The Front Page: Building CO_2 Emissions, Info and Feedback

Residents of the Finnish pilot building can register via a sign-up process, where residents enter email, password, and apartment number and give consent to the iFLEX consortium, so that their data can be used for research purposes during the pilot (Figure 29). During sign-up, users can check the “Yes, I want sensors” checkbox, and have sensors installed in their apartment. The sensors measure temperature, humidity and CO_2 values.

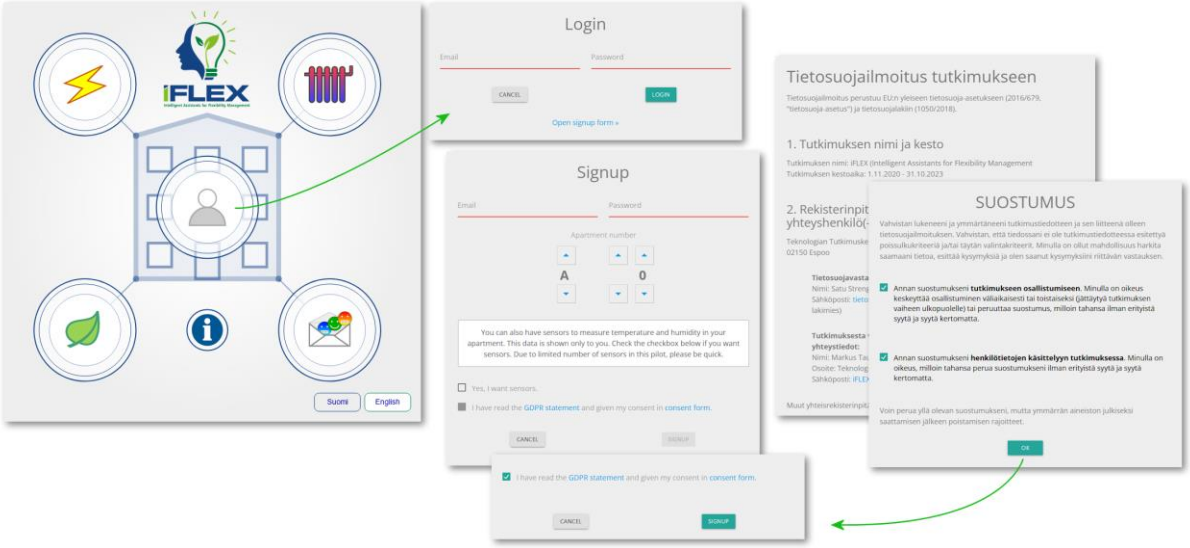

Figure 29: The Front Page: Log-in, Signup, GDPR and Consent

When the users have signed up, they can log in and enter the user page (Figure 30). There the users can view the apartment temperature, humidity and CO_2 values by selecting amongst the same six predefined time

ranges, as in the building case previously. Buttons are on top of the chart: one day, one week, two weeks, one month, six months and thirteen months. The button on the bottom right opens a feedback page where users can send feedback about apartment temperature and give free text feedback, as in the previously presented building case.

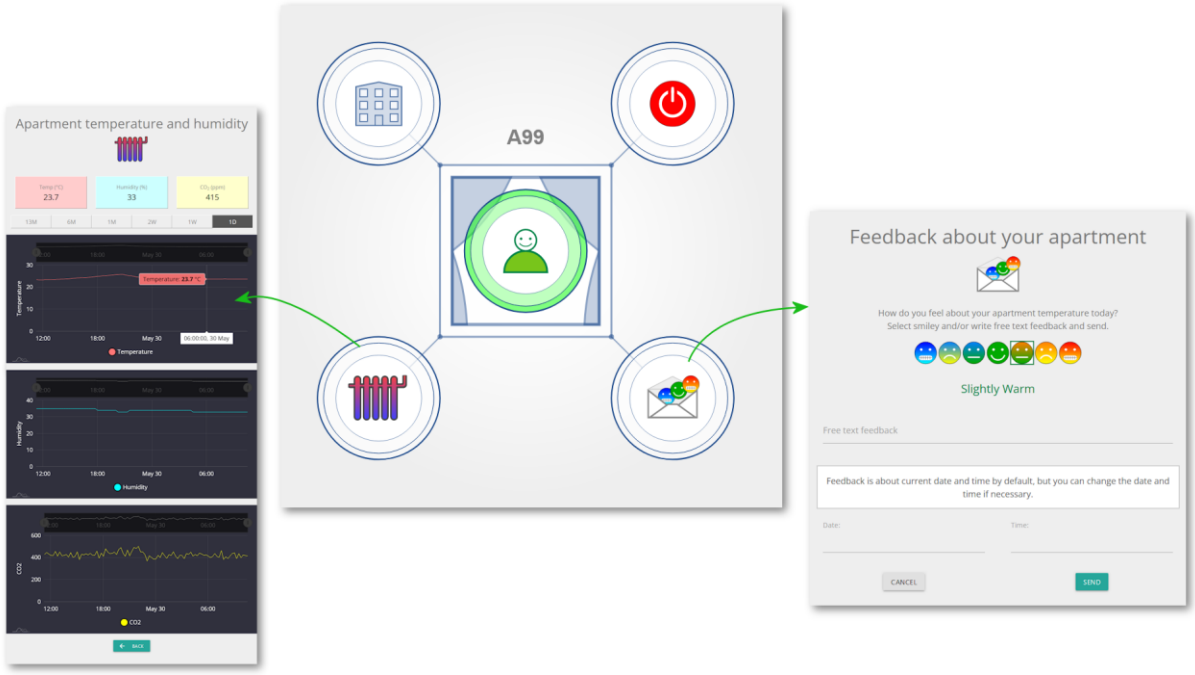

Figure 30: The User Page: Apartment Temperature and Feedback

The user button opens the “User Properties” page (Figure 31) where users can view the consent form and GDPR statement documents. If users want to change their password, it can be done here. The upper right button logs the user out and takes the user back to the front page. The upper left button also takes the user back to the front page without logging the user out.

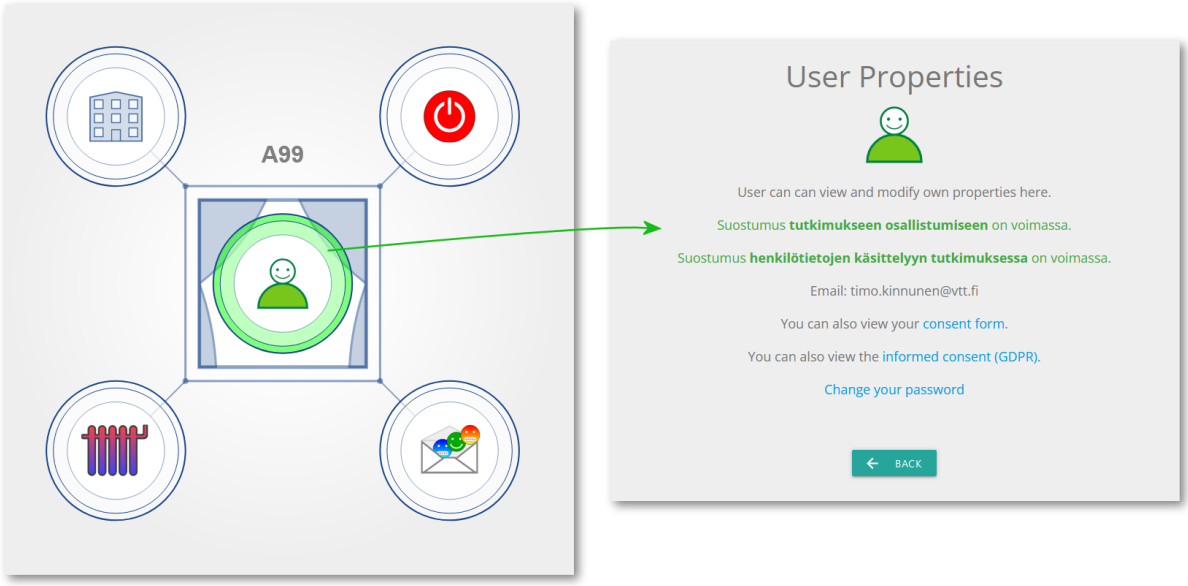

Figure 31: The User Page: User Properties

3.3.3.2 Facility Manager Interface

The Facility Manager Interface is depicted in Figure 32. It is designed for engineers monitoring the building. The current implementation consists of four main views: electricity power, district heating power, heating system and room temperatures. Electricity power and district heating power views display the respective power loads in 1-minute resolution. A variety of heating water temperatures from different parts of the heating system are represented in the heating system view. The room temperature view displays the room temperatures from apartments registered for the pilot.

Figure 32: Facility Manager Interface designed for the Finnish pilot

3.4 Implementation View

This section documents the different instantiations of the UI component per pilot, exposing the technology stack employed in each one of them.

3.4.1 Greek pilot's UI instantiation

This sub-section outlines the iFA's UI component utilised in the case of the Greek pilot (Figure 33). Starting from the frontend, which is the presentation layer of the application, the Greek pilot's UI is built on a combination of frontend technologies. The iFA Application UI is accessible either through a web view in the existing Heron mobile application or directly through a web browser. The frontend makes use of HTML[1], CSS[2] and various JavaScript[3] libraries, React [6], React-router-dom [7] and styled-components [8] just to name a few.

The static files which complement the iFA presentation layer are served from a UI backend server based on the Django web framework [9]. The UI backend consists of multiple components which enable different functionalities for the end user. To secure and load balance requests on multiple server instances, a NGINX [10] web server is configured as reverse proxy. This server, apart from load balancing and proper domain name matching, handles secure communications with TLS termination[4], Cipher suite[5] enforcement and client authorisation with x509 certificates in case it is required, i.e., the administration panel.

[1] What is HTML?: https://www.w3schools.com/html/html_intro.asp
[2] What is CSS?: https://www.w3schools.com/css/css_intro.asp
[3] About JavaScript: https://developer.mozilla.org/en-US/docs/Web/JavaScript/About_JavaScript
[4] TLS Termination for Network Load Balancers: https://aws.amazon.com/blogs/aws/new-tls-termination-for-network-load-balancers/
[5] TLS Cipher Suites: https://crashtest-security.com/configure-ssl-cipher-order/#tls-cipher-suites

As the base authentication and authorisation server, the third-party solution Keycloack [11] is utilised, provided by Heron. The client application makes a request to the backend with a JSON Web Token (JWT)[6]. The token is then introspected to Heron's Keycloack Auth server to verify its validity. If the verification is successful, the user may access the exposed REST[7] Application Programming Interface (API) to retrieve iFA personalised data (schedules, objectives, past DR Events, notifications) and real-time services to receive in-app notifications, through WebSocket [12] persistent connection. It is noted that the real-time services sub-component has not been implemented in the 1st phase.

Data persistence is achieved through a PostgreSQL database [13], while temporal caching is achieved through a Redis [14] cache instance. The Redis cache is utilised both for the real-time service and backend tasks caching. To elaborate more on the real-time service caching, as Django doesn't support asynchronous requests out of the box and provides no support for WebSocket connections, another python package is utilised in combination with Django, namely Django Channels [15]. This package introduces the concept of channels to enable multi-party communication. A channel layer, Redis in our case, stores messages which are to be distributed to interested parties. Once the client application is connected through a WebSocket connection to the backend channel (and channel group), it receives any messages which are in a pending state.

To be able to inform end users of required actions or alerts, a push notification service is utilised, provided by Heron. Upon an event reception from other iFA backend components, a task worker processes the event and creates a new notification. Depending on the user status (connected, disconnected), either a real-time WebSocket message is sent or a Push notification message is drafted and sent to the push notification server for further propagation to the end-user device.

[6] Introduction to JSON Web Tokens: https://jwt.io/introduction
[7] Representational State Transfer (REST): An architecture style for designing loosely coupled applications over the network, which is often used in the development of web services. Relevant link: https://restfulapi.net/rest-architectural-constraints/

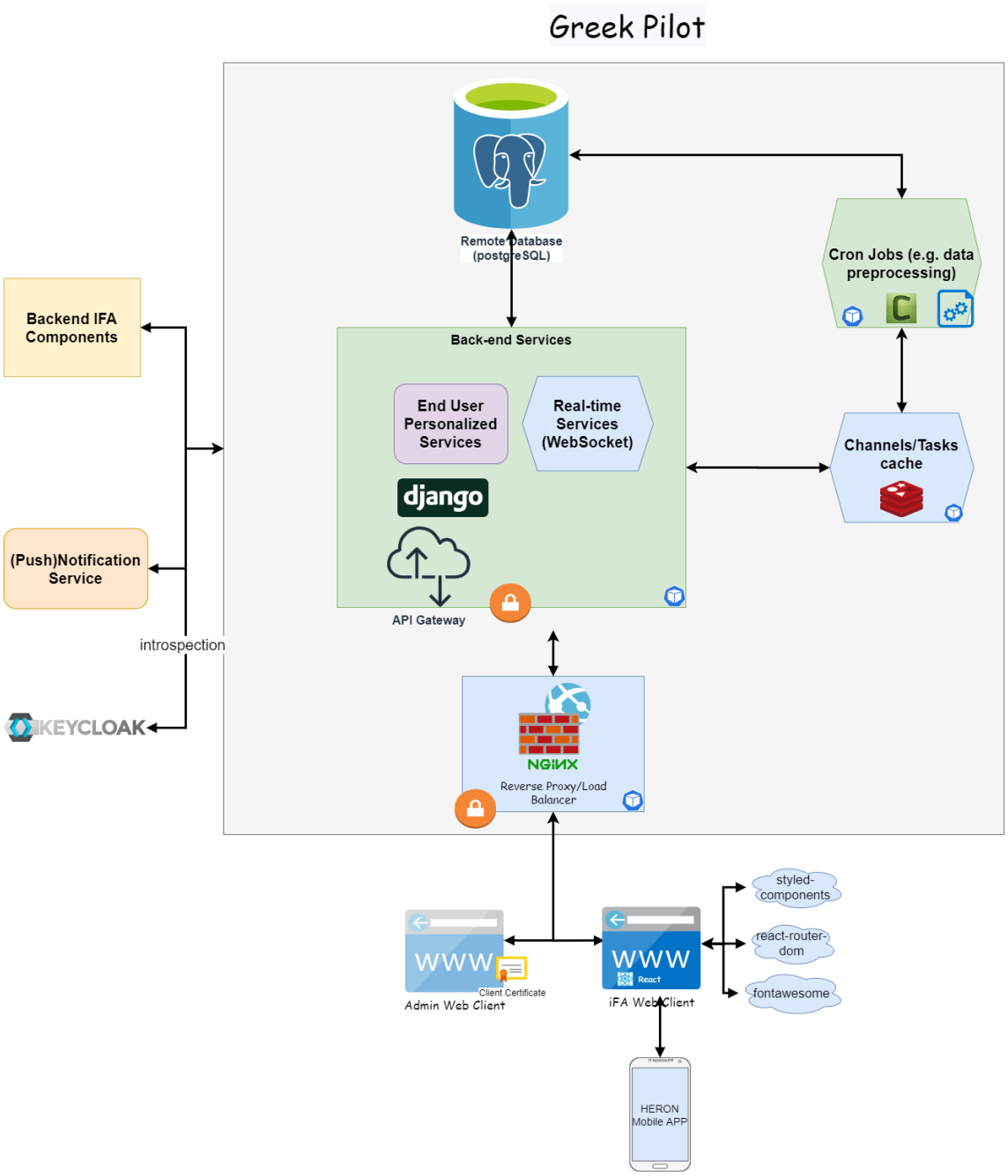

Figure 33: Technology stack of the web app's UI component for residential end users in the Greek pilot

3.4.2 Slovenian pilot's UI instantiation

The Slovenian pilot's UI (Figure 34) makes use of almost the same building blocks and implements similar functionalities as the Greek pilot's UI. There are three major differences compared to the Greek pilot's UI instantiation of the previous sub-section.

The first concerns the utilised frontend technology and provided solution, which in the case of the Slovenian pilot is a native mobile application instead of a web application. The mobile application is built using the React Native framework [16], a React-based framework which enables the development of applications for multiple platforms using a single codebase. A number of third-party libraries, such as expo-secure-store [17], react-navigation [18] and react-native-paper [19], are utilised to provide the desired visual and functional outcome.

The second difference compared to the Greek pilot's solution is the absence of the external Auth Server (Keycloack). Instead, the built-in Django Authentication and Authorisation services are utilised and extended with framework-specific python packages to enable token issuance and authorisation.

The third difference among the pilot-specific solutions is the "Push Notification Service", which in the case of the Slovenian pilot is not provided by Heron. Instead, push notifications are drafted and emitted from a service being part of the Django application server. It is noted that this "Push Notification Service" has not been implemented during the 1st phase.

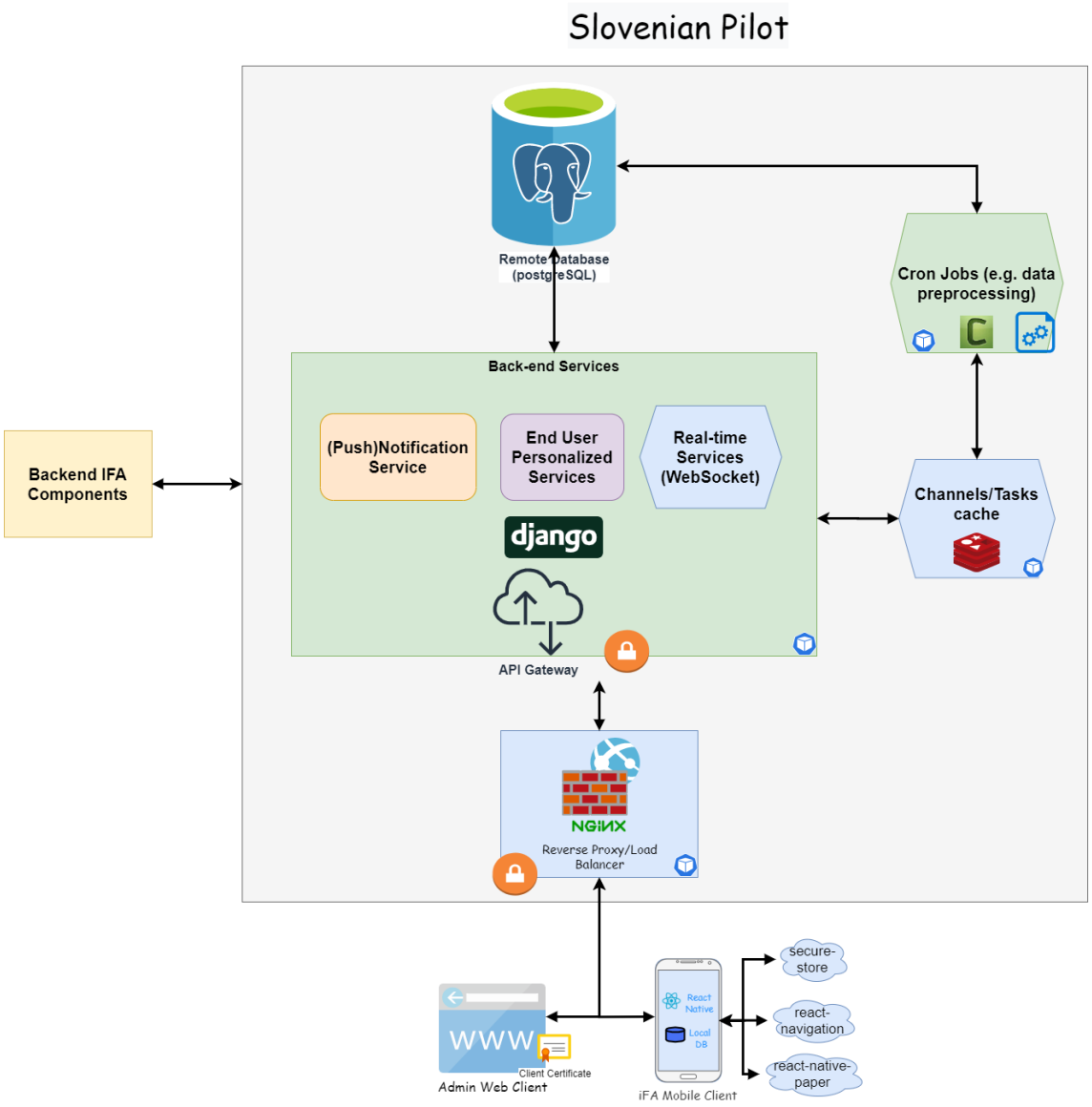

Figure 34: Technology stack of the mobile app's UI component for residential end users in the Slovenian pilot

3.4.3 Finnish pilot's UI instantiation

The User Interface is a web application accessed by the user through a web browser with an active internet connection. It is written with JavaScript, HTML, SVG[8] and CSS. It utilises modular programming techniques facilitated by ECMAScript 6 (ES6)[9], MVC (Model-View-Controller)[10] and observer patterns. It is made with a

[8] What is SVG?: https://www.w3schools.com/graphics/svg_intro.asp
[9] Overview of ECMAScript 6: https://262.ecma-international.org/6.0/#sec-overview
[10] Model View Controller pattern: https://en.wikipedia.org/wiki/Model-view-controller

Responsive Web Design (RWD)[11] approach, so it naturally supports different devices: smartphones, tablets, laptops and desktops, as shown in Figure 35.

Figure 35: The user interface supports naturally different devices

The application contains a backend and a frontend. The backend is written with Node.js [20], which is an open-source, cross-platform, JavaScript runtime environment that executes JavaScript code outside a web browser. The backend stores user data into a MongoDB database [21] and uses Mongoose [22], which provides a straight-forward, schema-based solution to model the application data. Almost all backend API calls are verified with JSON Web Token (JWT) to protect from unauthorised use. The JWT is created at server level and sent to client during successful log-in. Client stores and uses it in the following communication between client and server. A detailed description on how the backend is used as a proxy server for oBIX data requests can be found in D4.2 [23]. Figure 36 shows database models that are used in the iFLEX backend.

[11] Responsive Web Design – Introduction: https://www.w3schools.com/css/css_rwd_intro.asp

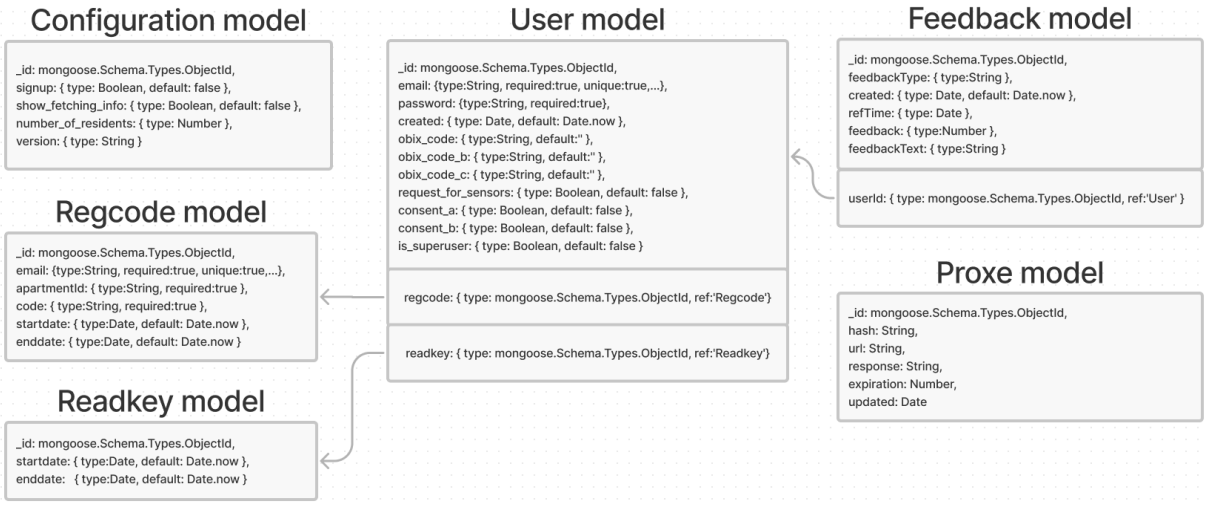

Figure 36: Backend models of the UI for the building community

4 Conclusions

This document aims to guide the development process with respect to the UI component. The design work was based on the use cases, requirements, and system architecture, as documented in previous deliverables, while it complements and updates the work reported in the first deliverable of this task, namely D3.4.

The envisioned functionalities of the UI solution in Phase 2 are reported by referring to the relevant requirements, based on the prioritisation agreed with the project's pilots and the achievements of Phase 1. Furthermore, the design of the UI component is analysed via three architectural views:

- Context view, presenting the interactions of the component with its environment at a high level;
- Functional view, focusing on the functionalities of the various sub-components of the UI;
- Implementation view, documenting the technology stack for the instantiations of the UI module per pilot.

The most up-to-date design of the UI is presented by exposing the interface of the prototype applications, which were developed for the three iFLEX pilots in Phase 1.

According to the agile approach adopted by iFLEX, the developments in Phase 2 and the additional features in Phase 3, which are related to the UI component, will be reported in the final deliverable of Task 3.3, namely D3.6. It is noted that co-creation activities with iFA end users during Phase 2 will assist in the process of redesigning the UI, as well as adding new features to it, for Phase 3.

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7 Appendix / Annex

7.1 Requirements documentation

The UI-related requirements are elaborated in this section. The abbreviations relevant to the columns on “Implementation” are clarified as follows:

- To be determined (TBD): This requirement’s implementation has not been prioritised for this pilot yet, but might concern it in the third phase of the project.
- Not Applicable (N/A): This requirement is definitely considered as out-of-scope for this pilot.

Story ID	***Title***	***Story narration***	***Source***	***Related requirements***	***Author***	***Developer***	***Priority***	***Implementation***		
								FIN pilot	**GR pilot**	**SL pilot**
FN-UI-01	Operation mode customisation	As an end user I want to be able to select among predefined operation modes and customise them according to my preferences, so that various operational choices are collectively determined on the basis of the operation mode.	PUC-1	FN-UI-02, FN-UI-05	ICOM	ICOM (GR, SLO)	High	TBD	1st Phase	1st Phase
FN-UI-02	User-defined time and operational constraints	As an end user I want the system to comply with my preferences regarding time and operation (e.g. temperature limits) of devices and assets, so that the automated operation doesn't hinder my comfort.	PUC-1	FN-UI-01, FN-UI-05	ICOM	ICOM (GR, SLO)	High	TBD	1st Phase	1st Phase

FN-UI-03	End-user feedback	As an end user I want to be able to provide the system with feedback on its operation, so that potential divergences from my wishes can be reduced/eliminated.	PUC-1		ICOM	VTT (FIN)	Low	1st Phase	2nd Phase	2nd Phase
FN-UI-04	Optimisation policy selection	As an end user I want to be able to define the system's optimisation policy, so that it conforms to my motives (e.g. cost, energy efficiency, environmental).	PUC-1		ICOM	ICOM (GR, SLO)	Medium	TBD	1st Phase	1st Phase
FN-UI-05	Automation level customisation	As an end user I want to be able to opt for a desired automation mode and activate it, so that I can choose the level of automation of iFLEX Assistant's operation whenever I want.	PUC-1	FN-UI-01, FN-UI-02	ICOM	ICOM (GR, SLO)	High	TBD	1st Phase	1st Phase
FN-UI-06	Diversity of means of interaction with the system	As an end user I want to select among various means of interaction with the system, so that I can choose the one I prefer for a specific purpose.	PUC-1		ICOM	TBD	Medium	TBD	TBD	TBD
FN-UI-07	Supported system interface languages	As an end user I want to be able to choose among various languages for the system interface, so that I can opt for my preferred one.	PUC-1		ICOM	ICOM & HERON (GR) ECE (SLO)	High	TBD	2nd Phase	2nd Phase

FN-UI-08	Provision of consent for the schedules of dispatchable assets	As an end user I want to be equipped with the ability to accept/reject the system-proposed schedules of dispatchable assets, so that I make sure that they comply with my will.	PUC-9, PUC-10		ICOM	ICOM (GR, SLO)	High	TBD	1st Phase	1st Phase
FN-UI-09	DR notification policy	As an end user I would like to set specific time periods in which DR notifications are not allowed, so that I am not disturbed within these time slots.	PUC-1	FN-UI-21	ICOM	ICOM (GR, SLO)	Medium	TBD	1st Phase	1st Phase
FN-UI-10	Insights into sustainability metrics	As a household end user I would like to set sustainability goals and track - based on them - my sustainability performance, so that I can get deeper insights into them.	PUC-3	FN-UI-15	ICOM	ICOM (GR, SLO)	Medium	1st Phase	2nd Phase	2nd Phase
FN-UI-11	Real-time energy data	As an end user I want to be equipped with the ability to inspect my energy data in real-time, so that I can have a clear view of the current status whenever I want.	PUC-7	FN-UI-12	ICOM	VTT (FIN) HERON (GR) ICOM (SLO)	High	1st Phase	1st Phase	1st Phase

FN-UI-12	Past energy data	As an end user I want to be equipped with the ability to inspect my past energy data, so that I can have a long-term view of my consumption/production data.	PUC-7	FN-UI-11	ICOM	VTT (FIN) HERON (GR) ICOM (SLO)	High	1st Phase	1st Phase	1st Phase
FN-UI-13	Flexibility reports	As an end user I want to receive flexibility reports, so that I can have a more clear view with respect to my participation in explicit DR actions.	PUC-4	FN-UI-22	ICOM	ICOM (GR, SLO)	Medium	TBD	2nd Phase	2nd Phase
FN-UI-14	Insights into energy efficiency	As an end user I want to set energy efficiency goals and track - based on them - my performance, so that I can control better my energy consumption.	PUC-7	FN-UI-15	ICOM	ICOM (GR, SLO)	Medium	TBD	2nd Phase	2nd Phase
FN-UI-15	Customised alerts	As an end user I want to subscribe to customised alerts (e.g. when household power consumption or daily/weekly electricity consumption exceeds a user-defined threshold or certain milestones regarding energy consumption-related goals are achieved/missed), so that I am assisted in achieving my energy efficiency-related goals.	PUC-1, PUC-7	FN-UI-10, FN-UI-14	ICOM	ICOM (GR, SLO)	Medium	TBD	2nd Phase	2nd Phase

FN-UI-16	Energy advising service	As a household end user I would like to subscribe to an energy advising service, so that I can improve my energy performance via following the proposed advice.	PUC-1, PUC-5		ICOM	ICOM (GR, SLO)	Medium	TBD	2nd Phase	2nd Phase
FN-UI-17	Inspection of energy tariffs	As an end user I want to see my energy tariffs whenever I wish, so that I can have a transparent view of - even time-variant - energy tariffs and the ability to adapt my energy consumption accordingly.	PUC-9, PUC-10		ICOM	ICOM (GR, SLO)	Medium	TBD	2nd Phase	2nd Phase
FN-UI-18	Available flexibility services	As an end user I would like to be informed about the available flexibility services, so that I can choose the most appropriate for me.	PUC-6	FN-UI-19	ICOM	TBD	Low	TBD	TBD	TBD
FN-UI-19	Declaration of interest in a new flexibility service	As an end user I would like to be able to declare to the relevant market actor my interest in a new flexibility service via my system, so that I can do that in an easy way.	PUC-6	FN-UI-18	ICOM	TBD	Low	TBD	TBD	TBD
FN-UI-20	End-user authorisation of system-proposed flexibility offers	As an end user I want to be able to authorise iFA to send flexibility offers to the market, so that I can decide when that happens.	PUC-9		ICOM	TBD	Low	TBD	TBD	TBD

FN-UI-21	DR event notification	As an end user I want to receive DR event information (implicit: notifications of a change in tariff price - or explicit: communicating the activation information), so that I can have a clear overview of the current DR actions.	PUC-1, PUC-8	FN-UI-09	ICOM	ICOM (GR, SLO)	High	TBD	1st Phase	1st Phase
FN-UI-22	Presentation of DR event history	As an end user I would like to be able to access my DR event history, so that I can review the impact of my participation in DR events.	PUC-4	FN-UI-13	ICOM	ICOM (GR, SLO)	Low	TBD	1st Phase	1st Phase
FN-UI-23	User Feedback on Satisfaction from DR Event	The users should be able to provide their feedback regarding their overall satisfaction from their participation in a DR event. This feedback takes into account multi-faceted incentives (e.g., rewards, peer pressure, etc.) provided to users for their participation to a DR event and their relation to the user discomfort, to determine a positive, a neutral or a negative perception on the DR event. This perception influences the probability that the user will participate in future DR events. This feedback may be	D5.2		AUEB	TBD	Medium	TBD	TBD	TBD

		visualised with 5-star Likert scale. Rationale: Allow the users to reflect on their overall satisfaction from DR events.								
FN-UI-24	UI for user standing with respect to DR performance as compared to others	Visualise relative user performance in DR events. E.g., a tree image in a forest, where the size and the greenness of the tree represent high DR performance. Negative/aggressive visualisation should be precluded. Rationale: Exercise peer pressure to the user with visualisation of comparative standing with respect to DR performance as related to other users.	D5.2		AUEB	TBD	Medium	TBD	TBD	TBD
FN-UI-25	UI for user standing with respect to participation as compared to others	Visualise relative user participation rate to DR events. E.g., a tree image in a forest, where the size and the greenness of the tree represent high DR participation rate. Negative/aggressive visualisation should be precluded. Rationale: Exercise peer pressure to the user with visualisation of comparative standing with respect to DR	D5.2		AUEB	TBD	Medium	TBD	TBD	TBD

		participation as related to other users.								
FN-UI-26	View asset schedules when offline	As an end user I would like to see the schedules of my assets in my mobile application even when offline, so that I can have a clear view of them at all times – regardless of internet connectivity.	Greek pilot discussions on iFA		ICOM	ICOM & HERON (GR)	Medium	N/A	2nd Phase	N/A
FN-UI-27	Actual schedules of assets	As an end user I would like to see the schedules of my assets, so that I can have a clear view of the schedules that are actually followed (and not only my schedule preferences).	Greek pilot discussions on iFA		ICOM	ICOM (GR, SLO)	Medium	N/A	2nd Phase	2nd Phase
FN-UI-28	Estimation of energy costs	As an end user I want to view an estimation of my energy costs, so that I can have an initial view of my upcoming energy costs for predefined periods.	D2.4		ICOM	TBD	Medium	N/A	2nd Phase	2nd Phase
FN-UI-29	Benefits from iFA's operation	As an end user I want to view an estimation of the benefits (e.g., savings in Euros, savings in CO_2 emissions, increase in self-consumed energy in kWh) from adopting iFA's suggestions, so that I can actually see what iFA offers to me.	D2.4		ICOM	TBD	Medium	N/A	2nd Phase	2nd Phase

NF-UI-01	The iFA UI of the Greek pilot should be integrated in the existing Mobile App	HERON has an existing app that will be used by its customers for participation in Smart Grid projects. The app should easily integrate iFA functionalities for iFLEX project participants. Rationale: Increased user experience. Interoperability.	Greek pilot discussions on iFA		ICOM	ICOM & HERON (GR)	High	N/A	2nd Phase	N/A
NF-UI-02	Easy onboarding in iFA usage	As an end user, I would like a wizard/ questionnaire to guide me and create my profile and automatically fill some settings (which can be later edited) upon my first log-in to the mobile application, so that I don't have to fill too much information myself.	Workshop between Slovenian partners and ICOM (as UI provider)		ICOM	TBD	Medium	N/A	2nd Phase	2nd Phase

7.2 Suggested UI design for new features

This section presents various mock-ups that have already been designed, which concern some new features that will be added in the mobile application during the second phase. It is highlighted that these functionalities have not yet been incorporated in the application.

7.2.1 User On-boarding Questionnaire

For the mobile application, certain screens were designed (Figure 37, Figure 38, and Figure 39) that are still in the mock-up stage and are within the focus of 2nd phase activities. These screens illustrate a simple process that users must go through when using the application for the first time, in order to set their objectives (Figure 37) and schedules (Figure 38), so they can easily set up their profile. The on-boarding questionnaire provides possible options that are based on an analysis of the metering data of the user's premises in the previous time period. These options can be selected, edited or deselected. The users do not need to answer all the questions in the on-boarding questionnaire, since they are given the possibility to skip the steps that they want.

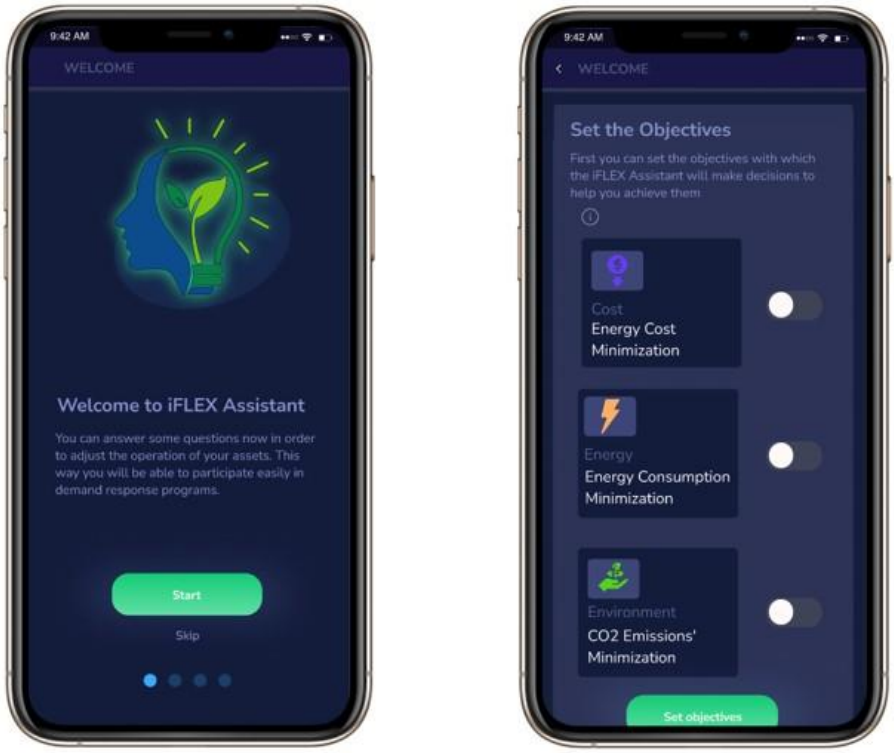

Figure 37: User on-boarding questionnaire – Welcoming and “Objectives” screens

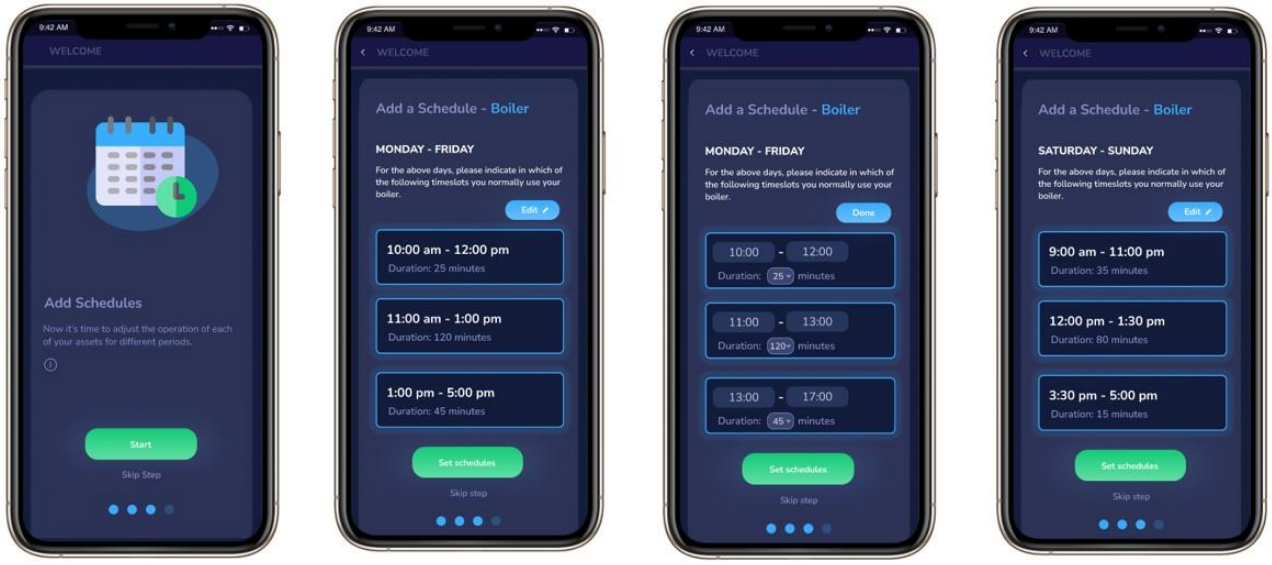

Figure 38: User on-boarding questionnaire – “Schedules” screens

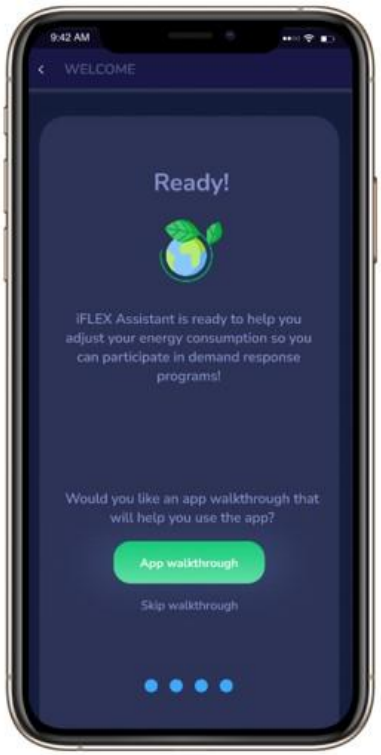

Figure 39: User on-boarding questionnaire – Final screen

7.2.2 Dashboard

In the second phase of the project, it is planned to introduce a new home screen for the application of the iFA. Instead of the “Energy” screen, the users will be able to see a dashboard, which summarises the key facts regarding energy consumption, assets’ operation, and DR events. The dashboard screens can be seen in Figure 40. By selecting “View More” in the above mentioned categories, the users will be directed respectively to the “Energy”, “Upcoming Schedules”, and “DR Participation” screens for more details.

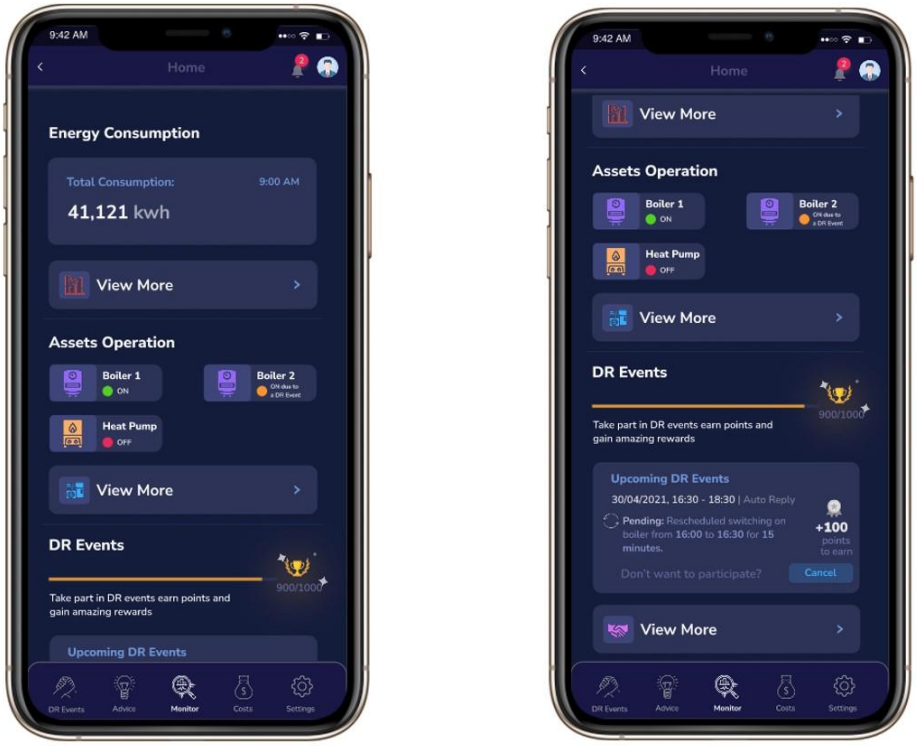

Figure 40: Dashboard screens

7.2.3 Upcoming assets' operation time

The "Upcoming Schedules" screen, which is mentioned in the dashboard sub-section (7.2.2), can be seen in Figure 41. Once the actual schedule for a flexible asset is determined, based on the iFA end users' objectives, DR events, and schedule preferences, the users will be able to access it through this screen. This feature will be added to the application during the 2nd phase of the iFLEX project.

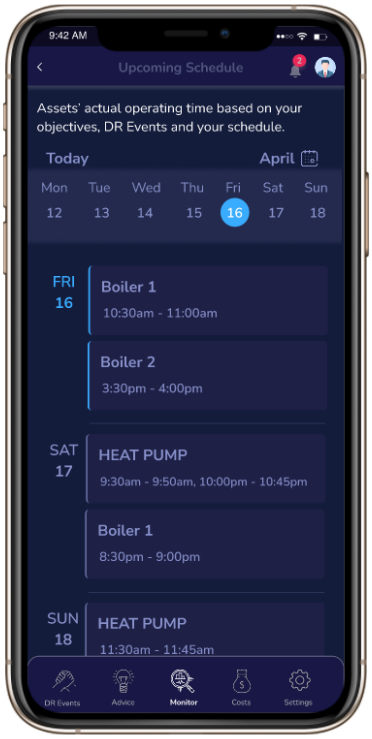

Figure 41: “Upcoming Schedules” screen