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* Type: P – Prototype, R – Report, D – Demonstrator, O – Other
** Security Class: PU - Public, PP – Restricted to other programme participants (including the Commission), RE – Restricted to a group defined by the consortium (including the Commission), CO – Confidential, only for members of the consortium (including the Commission)

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Abstract:
This document describes the prototype of Personalized application targeted at providing real-time recommendations to end users based on their behavioural profiling.

Keywords:
Prototype, personal application, recommendations, real-time data
# Revision History

The following table describes the main changes done in the document since created.

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Executive Summary

This document provides a basic overview of the ENTROPY’s Personal app prototype. It employs real sensor data from all three Pilot sites, and offers a tool to visualize this data, and receive energy saving tips, learn how to modify behavior, test the knowledge via quizzes and report any issues that they spot in the building. All functionalities were developed and implemented so that users can modify their behavior in order to increase the energy efficiency in the public building space.
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1. **INTRODUCTION**

ENTROPY’s *Personalized App* follows the behavioral subliminal educational approach. Behavioral-based learning adopts the idea that the instruction is centralized around individualization [1]. Understanding each individual characteristics and personality, provides an effective way of meeting the educational objectives of each course or behavioral objective.

**Behavioral-based Learning Systems** combine both motivation and task/tips-based learning techniques to enable people to learn without effort. In every organization or firm each individual must stay focused on his job’s tasks in order to achieve the main objective of the strategy.

While people should not be sidetracked from their everyday activities, raising a strong culture and driving energy-saving commitment among them, appears more than crucial.

Furthermore, people tend to resist change, especially when it comes to their work and their daily routine. Thus, a subliminal learning model is needed. Subliminal Learning [2][3] is acquiring knowledge and processing information on a subconscious level or by some means other than consciously, for later recall. Subliminal learning can be facilitated through audio and visual cues and metaphorical experience.
2. ENTROPY PERSONALIZED MOBILE APPLICATION

2.1 Personalized Application Overview

The core functional components of the ENTROPY Personalized App are given below:

(1) Android mobile app
(2) Educational Content in the form or Tips
(3) Educational content in the form of Quizzes
(4) Questions in the form of Surveys
(5) Visual representation of buildings
(6) Visual representation of various sensor streams (energy, Temperature, building KPIs, etc.)
(7) Profile settings

A digital user experience from the Personalized Application includes:

- The user can select and solve educational quizzes, receive notifications and educational tips, can check in real time energy indicators and energy consumption graphs and push thermal comfort and various building faults/conditions to the Entropy (crowd-feeding). All content is personalized and adapted to users’ behavioral profile
- The Personal application has an objective to create various interactive behavioral KPIs without any gaming element in order to test users’ ability to shift profile due to personalized educational content.

2.2 Personalized App Software Development

The Development of the personal app took place on Android SDK, using Android Development Tools - Android studio 3.0.

Development life cycle was the following:

- Requirements
- Analysis & Design
- Development & Testing
- Deployment
- Support & Upgrades.

Testing procedures are as follows:

- Test Case Preparation: Designing test cases.
- Manual testing
- Usability testing
- Performance testing : using Android tools
- Device Testing: Execute test cases in other devices of the lab, install the app in different emulators of different versions of Android.
The ENTROPY personalized app will be available on line on Google Play repository for real time downloads from users

2.2.1 **Reporting of Issues**

The issues are reported by Pilot Campaign Managers via Entropy’s GitHub development platform.

2.2.2 **Resolving Issues**

The open issues are re-tested using Quality Assurance procedures. Consequently the following steps are done:

1) Bug fixing
2) UX/UI redesign
3) Code modifications

2.3 **Personalized App Screens and Functionalities**

This section gives an overview of Entropy Personalized App demo application screens which core functionality will be used with extended set of questions and recommendations. The user downloads the APK file and installs the app on his or her smartphone. He/she then registers in the app and he is ready to engage. The following Figure shows Welcome screen with Sign in functionality.

![Figure 1: ENTROPY Personalized App login screen](image)
The demo of the application can be viewed below:

**Available app screen options:**

1. Dashboard
2. Real Consumption Chart
3. Tips
4. Quiz
5. Questions
6. Report Events
7. Settings
8. Engagement / Metrics
9. Logout

**Dashboard Screen**

![Dashboard Screen](image)

**Figure 2: Dashboard screen: available registered buildings**

**Description:** Lists all the available register buildings of the platform
Real Consumption Bar

**Description:**

User can choose a building from the list, and all the available streams for selected building will be loaded.

Data are being visualized in two ways, either as bar graph or as line graph.

![Real Consumption Bar](image-url)

**Figure 3: Real Consumption Bars: building consumption curves and sensors**
Real Consumption Charts Screen

Figure 4: Real Consumption Charts

Description:

The chart displays the consumption profile of all the registered buildings of the entropy platform.

The application supports two ways to visualize data: Pie graph or Bar graph.
**Description:** The bar displays the consumption profile of all the registered buildings of the entropy platform.

**Available KPIs on mobile screen**

- Energy consumption per sq. Meter
- Energy consumption per occupant
- Current energy consumption
- Surface number of sq. Meter
- Number of sensors
**Tips – Quizzes – Questions**

![Image of Tips – Quizzes – Questions]

**Figure 6: Tips – Quizzes – Questions**

**Description:** The notification screen shows recommendations per end user.
Report Events

Figure 7: Report Events

Description: Users can report a malfunction to the platform, for the current register buildings or sub areas, by describing the fault or taking a picture of it.
Personal Settings

**Description:** Users can display the application in one of the following languages:

- English
- Italian
- Spanish
Mobile App Engagement / Metrics

Description: This functionality calculates the actions of the user on the app and it returns 3 KPIs:

- Engagement
- Knowledge
- Effectiveness
Logout

Description: Logout from the application
2.4 Personalized App Behavioral KPIs

Types of behavioral KPIs, the Personalized app uses and generates are given in following subsections. These KPIs were analyzed and produced in W2 Deliverable 2.4, in order to be an entry for the ENTROPY Analytics toolbox. The Personalized app has outputs digital interactions that combined with Energy and sensor stream data can give a calculation on the behavioral impact on energy efficiency.

2.4.1 Effectiveness

Effectiveness is a quantification of the game’s total effect in the overall sustainability of the building and occupant behavior regarding sustainability issues.

Key factors to calculate mobile app effectiveness are:
- energy (incl. electric, gas, oil) and savings
- tips and quizzes read
- quizzes answered correctly
- faults registered and resolved

Regardless of the other metrics, this is not about measuring each individual’s effort. It is about describing in which efficiency the other metrics are weighted. For example, the awareness to the app might be high but the total effectiveness might still be low. This maybe means that people interact with the application but do not act and thus the engagement (explained below) might be low. In other words, their attitude is changed but their behavior is still the same. The Effectiveness metric is analyzed and calculated in D2.4

2.4.2 Engagement

One of the most important metrics is Engagement, due to the fact that it takes into account all aspects of interaction with the system through ENTROPY Personal mobile app.

Critical factors to calculate user’s engagement are:
- the number of logins and pageviews
- tips and quizzes read
- questions answered correctly
- faults registered and resolved.

According to Bloom’s taxonomy, the above-mentioned metrics are referred to the value that a person attaches to a particular object, phenomenon, or behavior. This ranges from simple acceptance to the more complex state of commitment (engagement). The Engagement metric is analyzed and calculated in D2.4

2.4.3 Knowledge

The main purpose of measuring the user’s interaction with the app is to identify what he or she has actually learned. The Knowledge metric is a quantification of the perceived level of knowledge among players by evaluates the correct answers from all the quizzes. At Bloom’s taxonomy it referred as internalizing values (characterization). This means that there has been created a value system that controls his behavior. A simple example is when the person displays professional commitment to eco-friendly practice on a daily basis or revises judgments and changes behavior in light of energy-saving tips. The Knowledge metric is analyzed and calculated in D2.4
3. CONCLUSION

This document reports deployment of ENTROPY’s Personal mobile application with functionalities developed in order to provide a tool to public building user to monitor energy consumption, learn how to improve energy savings and ultimately adopt behavior which will lead to improved energy efficiency.
BIBLIOGRAPHY – REFERENCES

