BeeSmart

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Phase I – User and Task Analysis

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Project's idea description

BeeSmart is a new mobile application designed to help users manage their energy consumption, and consequently saving money. The application aims to provide a user-friendly interface for controlling smart devices, automating everyday tasks, and ultimately reducing energy costs. By allowing users to set personalized energy-saving and money-saving goals. BeeSmart uses an AI to adjust every user's device in order to accomplish these objectives without compromising their comfort and offers suggestions to enhance energy efficiency. On top of that, BeeSmart also provides to the user the full control of their smart devices whenever they want to, and the app will readjust the settings to still reach the pre-established goals. The mobile application moves forward to not only help everyone make the world more eco-friendly regardless of their age group or technology proficiency.

Related apps/devices/systems

After some research, we managed to list some existing applications that operate on smart home management and energy consumption monitoring:

- Google Nest: Smart home control and automated thermostat adjustments, but it is **limited to Google devices and internet connectivity**.
- Ecobee: Energy monitoring, heating and cooling systems and remote home management, however, it has a **complex setup and a high cost**.
- Sense Energy Monitor: Energy usage tracking, still, requires the **installation of additional hardware and lacks automation features**.

These well-known applications prioritize user convenience and energy savings, but they fall short in some areas. BeeSmart's goal is to combine the strengths of these applications while addressing the problems they encounter.

Questionnaire highlights

The questionnaire collected responses from 20 participants that gave us a solid understanding of who is the target audience of our mobile application, how they would like to see BeeSmart come to life, and what they would like to see on our application. We will show the most intriguing question we've asked from each section, visioning to help our PACT analysis (People, Activities, Contexts, and Technology) and the average answer of our participants:

1. **Age**:
Almost everyone that answered the report is between the ages of 18 and 24, so most of the population consists of university students.

2. How many smart devices do you have in your home?

Two-thirds of the participants reported having at least one smart device at home, with nearly half indicating ownership of four or more devices. We find this important as it highlights the participants' availability to become potential future users of our application.

3. Which type of smart devices do you have at home?

The most answered device was TV, followed by lights and fridge. This is crucial information so that we could improve our application on the management of these devices, for instance, on the control of inactivity while the TV, lights, or fridge are turned on to help save energy, that is BeeSmart's goal.

4. Which functionalities would you like to have available on an application of management of smart devices?

We've asked the participants to choose at most 3 from a variety of options we gave them. With this, we've reached the conclusion that the participants find essential on a application like this the feature of receiving detailed reports on the user's energy consumption on each device and a simple interface to be able to control their smart devices, these information helps us to know where to guide our efforts to make an eventual user satisfied. Also, with just only 3 votes, the least preferred feature for BeeSmart was news related to saving money and energy, that indicates that it would not be a good idea to bother users with possible annoying notifications on news they are not interested in.

In short, this questionnaire was important to help us understand the potential user and study <u>who</u> they are, <u>how</u> are they currently monitoring their energy consumption, electric bills, <u>how</u> they use their smart devices, and <u>how many</u> (if any) they have available at home.

Detailed statistics and summaries of the questionnaire results are included in the annex section of this report.

PACT Analysis

Based on our questionnaire's answers, we were able to make a detailed PACT analysis:

● People

The target audience includes predominantly young adults, primarily university students, who live with their families. Most of them have medium-high familiarity with technology. However, there are users that possess lower technological skills, so the app must be designed to accommodate different levels of technological proficiency. While most users have at least one smart device at home, their engagement with energy management is limited, with many users prioritizing convenience over active energy monitoring.

Activities

Currently, most users never check their energy consumption, and if they do, it is only once a month, this would make sense and be expected considering the most common age gap for people who answered the report is between 18 and 24, even though they use smart devices in various parts of their homes. Their primary motivation for using smart devices is comfort and automation, with energy savings being a secondary concern. The activities they currently do with their smart devices are primarily for convenience and automation on their daily tasks. Many users prefer a balance between automation and manual control.

- **Context**

BeeSmart would be used primarily in domestic environments, where users can control their smart devices from their smartphones. Given that users are interested in engaging with an app that monitors these devices at home or remotely, the app should facilitate easy and reliable access to connected devices.

- **Technologies**

Users are interested in an application that will leverage Internet of Things (IoT) technologies to connect and manage a wide range of smart home devices, such as televisions, lights, and fridges. Users primarily already use **mobile apps** to control their devices. Additionally, they would like personalized suggestions for energy-saving and allow users to automate devices to achieve specific goals, such as reducing their electricity bills. It is important to them that an interface has a user-friendly design.

We would like to point out that our PACT Analysis is influenced by the limited sample of respondents who participated in our questionnaire. For instance, most responses were from people between 18 and 24, which may not reflect the target audience of BeeSmart. In fact, we expect that users aged in a range of 25 and 39, who are more likely to be paying their own bills, would have a higher interest in using the application.

Personas

- **João Silva**

- <u>Age</u>: 23

- <u>Occupation</u>: Master's Student in Software Engineering

- <u>Description</u>: "I'm laid back and love when things take care of themselves, but I always keep an eye on comfort. I like to control, but only when it's easy – why bother with the details when technology can do it for me?"

- <u>Lifestyle</u>: João loves technology and enjoys having things automated to make his life easier. He's not a fan of spending time on tasks that could be done with a tap on his smartphone, preferring smart home systems to handle everything from turning on the lights to adjusting the temperature. He spends most of his time at home, where he studies and plays video games, and isn't too worried about tracking every detail of his energy use – he just wants comfort without effort. João is practical when it comes to tech: he doesn't obsess over the latest gadgets, but he'll gladly use anything that simplifies his routine. His lifestyle is all about convenience and balance between enjoying modern comforts and saving energy.

- <u>Objective/Needs</u>:
    - João is focused on simplifying his daily routines, especially through automation. He seeks to reduce his energy consumption but without having to manually adjust settings constantly.
    - He needs an app that can automate smart devices according to his schedule, such as adjusting lighting and temperature automatically during his study sessions and downtime.
    - João prefers convenience over control, meaning he needs a system that can handle most tasks with minimal input from him, providing real-time updates without overwhelming him with details.
    - As a busy master's student, he also values comfort in his home environment, so it's crucial that any energy-saving measures don't compromise his day-to-day convenience.

- <u>Frustration/Pain Points</u>:
    - João often gets frustrated with manual daily tasks that could be automated because he is a busy man, and doesn't want to waste time. He dislikes having to adjust settings manually.
    - Although João is tech-savvy, he sometimes finds it tedious to configure new devices, especially when they require more effort than anticipated.

- **Lúcia Pereira**
- <u>Age</u>: 30

- <u>Occupation</u>: Portuguese Teacher

- <u>Info</u>: "I'm practical and protective, always thinking ahead to keep things running smoothly for my family. I'm cautious, but I want to make sure everything is safe and efficient, even if that means doing it all myself"

- <u>Lifestyle</u>: "Lúcia is a busy mother and teacher, always juggling her work and home life. She's cautious with her spending and loves to find ways to save money, especially when it comes to her energy bills. Technology isn't her strongest suit, but she uses it to keep her home running smoothly and her child safe" She likes being able to check on her appliances and ensure everything is in order, even when she's not at home. Lúcia prefers apps that are simple and reliable, and she's not afraid to spend a bit more time learning how to use them if they help her save money. Family

comes first, so her choices are always practical, focused on security, and driven by a need to protect and provide for her household."

- Objective/Needs:
    - Lúcia's primary need is to save on her energy bills while keeping her home safe for her child.
    - She needs clear and simple notifications when appliances are left on or when her energy usage is nearing a preset limit.
    - Since Lúcia is not very tech-savvy, she needs an interface that is intuitive and easy to navigate, with minimal setup required.
    - Additionally, Lúcia prefers an app that allows her to supervise her child's activities, especially through smart home monitoring features like cameras or TV usage tracking.

- Frustration/Pain Points:
    - Lúcia struggles with complicated interfaces and often feels frustrated when trying to configure her smart devices.
    - She feels overwhelmed by technical jargon and too many options when using smart home apps, making it harder to achieve her goal of saving energy.
    - Lúcia also finds it challenging to balance cost savings with maintaining safety and comfort for her child.

Activity Scenarios

- **João Silva**

João had a long and tiring day sitting for the online classes of his master's degree and therefore, once he is through, he reaches for his mobile phone and opens BeeSmart to check how much energy he has consumed and if his other smart devices are operating well.

While logging in, regarding energy usage, João is welcomed by a notification informing him that his energy consumption is fast approaching the threshold line he had set for that month, if not he is already out of the target range.

Satisfied, he proceeds to the automation settings where he had set different devices to be activated or deactivated depending on how his routines are. The application indicates that both light and heating have been programmed to turn off at exactly eleven o'clock pm which is around the time he usually goes to sleep.

Nonetheless, some few minutes passed and João wanted to play video games instead. With the help of BeeSmart, he deactivates the automation system temporarily and changes the ambience lights to a more relaxing movie light. The application also reduces the temperature on the air conditioner by a few degrees so that he can compensate for the excess energy while ensuring comfort. Later, when he is done with

gaming, BeeSmart brings back his normal schedule without him forgetting to turn off his devices so that he does not be forced to stand up after he has made himself comfortable on the bed.

- **Lúcia Pereira**

Lúcia is busy at work when it suddenly hits her that her daughter would be returning from school soon. Hence, she opens BeeSmart on her mobile device to ensure that everything is in place. Once she has logged in, Lúcia begins analyzing the state of her smart home appliances.

She notices that the television is still up and running from the previous morning and immediately uses the BeeSmart application to switch it off to save power. She also checks one of her smart security cameras to verify if the child returns safely at home.

After ensuring everything was fine with her child, Lúcia got another notification from BeeSmart with a proposal to change the temperature settings to save energy while the house was empty. She agrees with the suggestion, connects to the system from her phone, and decreases the thermostat's settings, thereby saving on electricity bills without having to feel cold at home.

Before knocking off from work, she goes ahead and sets the heating system to come on after 30 minutes from the time of her arrival, so that the house can be warm and ready when they come back.

Functionalities

BeeSmart includes the following key features:

- **Smart Device Control**: Enables users to connect and control multiple smart devices from a single interface or delegate this control to the app's AI.
- **Energy Monitoring**: Provides real-time data on energy consumption, allowing users to track savings effectively.
- **Automated Suggestions**: Offers personalized recommendations for energy-saving practices based on user behavior from a programmed AI.
- **Goal Setting**: Allows users to define specific energy-saving targets, with the app automating actions to meet these goals.
- **Alerts and Notifications**: Sends timely notifications regarding energy usage and device status, helping users stay informed.

- **Readjustments**: BeeSmart is programmed to readjust to new control settings of other devices when a user manually controls one of them to continue to meet his goals.

Annexes

- **Questionnaire**

1. Age:
   - <18 – 0%
   - 18-24 – 90.5%
   - 25-39 – 4.8%
   - 40-60 – 4.8%
   - >60 – 0%
2. Gender:
   - Male – 66.7%
   - Female – 33,3%
3. Occupation:
   - Student (12th grade or below) – 9.5%
   - College Student – 76.2%
   - Employed – 9.5%
   - Unemployed – 4.8%
4. Familiar aggregate:
   - 1 – 4.8%
   - 2 – 14.3%
   - 3 – 52.4%
   - 4 – 28.6%
5. Level of familiarity with technology:
   - Very low – 4.8%
   - Low – 19%
   - Medium – 57.1%
   - High – 19%
6. Monitoring energy frequency:
   - Never – 61.9%
   - Monthly – 23.8%
   - Weekly – 9.5%
   - Daily – 4.8%
7. Number of smart devices at home:
   - 0 – 33.3%
   - 1-3 – 19%
   - 4-6 – 42.9%
   - 7+ - 4.8%
8. Use of smart devices on different divisions of the house:
   - Yes – 57.1%
   - No – 42.9%
9. Goal of using smart devices:
   - Comfort and automation – 61.9%
   - Saving energy – 9.5%
   - Safety – 4.8%
   - Don't use – 33.3%
10. Which type of devices at home:

- Lights – 35%
- TV – 70%
- Windows – 10%
- Plugs – 20%
- Fridge – 30%
- Voice Assistant – 15%
- Air Conditioner – 15%
- Safety System – 15%
- Door/Gate – 25%
- Vacuum Cleaner – 5%
- Don't Have – 5%

11. How do you the monitor these smart devices:
- Website – 9.5%
- Mobile Application – 47.6%
- Voice Assistant – 19%
- Don't Use – 42.9%

12. Do you consider a mobile application focused on smart device management useful?
- Yes – 76.2%
- Neutral – 23.8%
- No – 0%

13. How would you prefer to have a mobile application control your smart devices:
- Automatic – 14.3%
- Manual (with help) – 28.6%
- Combination between Automatic and Manual – 57.1%
- Would not let control – 0%

14. Which are the main difficulties you face during the use of an application:
- Confusing interfaces – 52.4%
- Unnecessary notifications – 57.1%
- Difficult setup – 23.8%
- Uselessness – 14.3%
- Lack of updates – 9.5%
- Bad updates – 14.3%

15. Which features would you like to see on a smart device management application:
- Detailed reports of my energy consumption on each device – 66.7%
- Simple interface to control my devices – 47.6%
- Handicap support – 28.6%
- Personalized suggestions on saving energy made by an AI – 28.6%
- Smart automation on my devices to achieve a pre-established goal – 42.9%
- Always-available monitoring of the state of my devices and goal progress -42.9%
- Visualization of my home and its divisions with the smart devices on them – 38.1%
- News about ways to save energy and money with smart devices – 14.3%

- **Summary of results**

The results of the questionnaire reveal that most respondents are young adults, primarily university students who are still living with their families. Most of them have some level of familiarity with smart devices and technology, with the majority indicating a medium to high level of tech-savviness. However, there are also users with lower familiarity with technology, which suggests that BeeSmart must be intuitive and user-friendly to cater to different levels of expertise.

In terms of energy monitoring behavior, most users do not actively check their energy consumption, with a significant portion admitting they never do it. Those who monitor their energy usage tend to do so infrequently, typically only once per month. Despite this, many respondents have smart devices in their homes, such as televisions, lights, and fridges, and they often use these devices in multiple rooms. The main motivation for using smart devices is the convenience and automation they offer, while only a small percentage of users prioritize energy savings.

Many respondents expressed interest in a mobile application for smart device management, with most preferring a combination of manual and automatic control over their devices. However, the main pain points that users face with current applications include confusing interfaces, excessive notifications, and complex setup processes. In terms of desired features, detailed reports on energy consumption, a simple and intuitive interface, and smart automation to achieve specific goals were the most requested. Users also showed interest in personalized suggestions for saving energy and the ability to monitor the status of their devices in real-time.