Evaluating and Improving ecobee's Air Quality Feature

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Abstract – the project I worked on at ecobee had the intention of evaluating the current state of ecobee's Air Quality feature and providing definitive recommendations with the goal of improving customer satisfaction. This project would include and impact the energy product, firmware, marketing, and customer service teams. Most importantly, the project would result in well-defined next steps that would impact the end customers' experience. The outcome of the project included a thorough Concept Document that presented the background, situation, data, and recommendations for the Air Quality feature. This document was formally shared with the leadership team to align on the recommendations and begin work on implementing and testing the recommended solutions.

Keywords – Product Management, Air Quality, Smart Home

I. SITUATION OF CONCERN & PROJECT OBJECTIVES

ecobee is a smart home automations company that builds products such as thermostats, cameras, occupancy sensors, and other internet-connected tools for homeowners. The company is most well-known for building the world's first "smart" (internet connected) thermostat. ecobee's thermostats save energy by automatically adjusting the temperature settings based on factors such as room occupancy, peak hours, and community energy usage. Thermostats also allow homeowners to set the home temperature using their phone, set custom schedules, and set up integrations with voice assistants such as Siri. ecobee's newest addition to their product line is the ecobee Smart Thermostat Premium which includes air quality monitoring, built-in voice control and a room sensor.

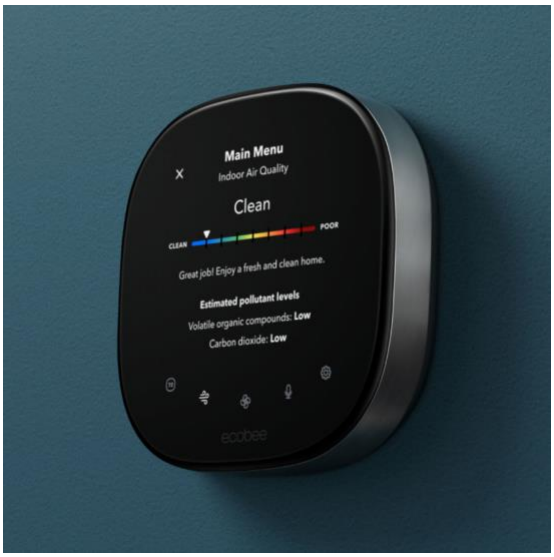

Figure 1: Air Quality on the Smart Thermostat Premium [Image Source: ecobee, 2023]

As a Product Manager Co-op on the energy hardware team, one of my first tasks was to analyze and summarize customer feedback from a long-term customer satisfaction survey. This was the first survey conducted of its kind at the company as customer feedback surveys were only sent a few weeks after a user installs their device. The results of the new survey showed that the Air Quality feature on the premium thermostat scored relatively low in terms of Customer Satisfaction with a CSAT score of [undisclosed]%. After conducting sentiment analysis and tagging open-ended comments by theme, Air Quality was found to be a top source of detractor feedback.

One of the team's main objectives for the year was to improve overall customer happiness. This includes moving metrics such as NPS (Net Promoter Score) and CSAT (Customer Satisfaction Score). As a source of detractor feedback, Air Quality was determined to be an opportunity to improve the overall NPS. While in the middle of my co-op term, I was tasked with addressing this problem. My objective was to determine the possible options and make a recommendation to improve the overall Air Quality customer experience. It should be noted that the scope of the project did not include solution implementation or detailed requirements. Instead, the goal was to gather the right context and analysis to pitch the recommendation to the leadership team. I aimed to answer this question: *what should the team do to improve the Air Quality customer experience?* This report will focus on this question, and performance will be measured by CSAT (Customer Satisfaction Score).

II. ENGINEERING ANALYSIS

The engineering analysis of the problem defined above was one of the most important steps in the project. It involved understanding how the air quality sensor works, conducting a situational analysis, and exploring and prioritizing options to eventually make a recommendation.

Understanding how the feature works

The first step in the engineering analysis process was to gain an understanding of how the air quality feature works. The product manager that owned this feature was on leave, so instead I managed to develop a relationship with the firmware engineer that did most of the implementation during the development of the product. I set up a few meetings to walk through and understand how the sensor and logic works. I also read up on documentation such as the sensor datasheet and other internal company resources. While going through this, I made sure to document everything on a page in my company's wiki platform. Documenting helped me structure my learning while also providing a resource for co-workers to reference when dealing with air quality.

This process helped me understand how the feature works but also revealed that the feature has some history behind the decisions made and the way it was implemented. This was the first time that ecobee has included an Air Quality sensor in one of their devices. During the product development, there was contention regarding which sensor to use and how air quality was presented to the end user. It was important for me to dig into this because any recommendation that I make to the team should consider and acknowledge past research and decisions. I sat down with the Director of Product who oversaw the air quality implementation. I learned about the rationale behind adding air quality, the limitations they faced, as well as the program risks that were acknowledged.

Situational analysis

With an understanding of how the air quality feature works as well as the history behind it, the next step was to dig into the current problem from the customer perspective. At this point, I identified multiple customer pain points from the CSAT survey. However, I had many open questions and overall knowledge gaps.

To fill these knowledge gaps, I started a project with the Research and Insights team. They are responsible for all field trials, user research, and surveys in the company. The first part in this project was to do Desktop Research. The goal was to consolidate all previous research related to Air Quality to see if we can address the knowledge gaps that I identified. This process proved to

be very helpful. ecobee conducts thorough customer field trials prior to releasing a new product. There have also been previous data investigations as well as customer service reports that have information regarding customer feedback.

Table #1: Desktop Research Template

Past Research	Description	Key Findings
Survey #1		
Field Trial #1		

The output from this analysis was a document with detailed customer insight. I identified 4 critical customer expectations that customers expressed during field trials. I was able to assess if and how ecobee meets these expectations using customer feedback from the CSAT survey. For example, one insight was that Customers do not expect poor air quality in their home very often, and if there is, they expect it to be less than a few times a month. I was able to assess that this expectation was not met by analyzing customer feedback comments.

Data analysis

A critical step was to support the customer insights with data. This helps back up the customer claims and paints an overall picture regarding how significant customer feedback is. Our team had little data analytic support, so I opted to lead this investigation myself. After learning a bit about the way data is structured and stored in the company, I identified metrics and used SQL to obtain some current and historical data regarding the air quality feature. Each metric was specific to a customer insight. For example, I defined a metric to look at the frequency in which customers see poor air quality on their device. This data analysis helped validate customer feedback and revealed seasonal and geographical patterns that were not visible through customer feedback.

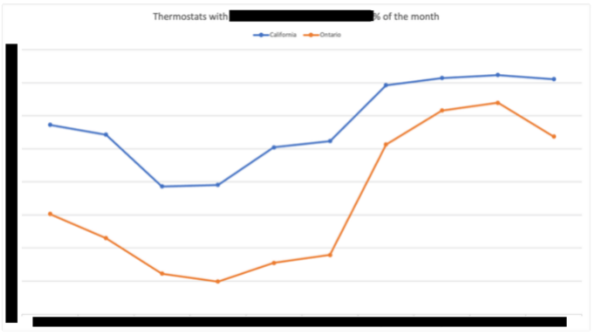

Figure 2: Air Quality Geographical Trends [Image Source: ecobee, 2023]

Exploring options

With the right context on technical implementation as well as customer insights it was time to begin exploring the options available to address the problems that customers are facing. The first and most important part was to meet with the sensor manufacturer. I got in contact with the team in charge of the sensor development and was able to meet with the engineers and PMs that have in depth knowledge of the sensor. The goal was to share the feedback that we are receiving from customers and learn about the options available from the technical side. This was a valuable meeting because we had little control over the sensor configurations. After a productive conversation and a follow up meeting, we identified 3 options on the sensor side. It was also important to explore customer-facing solutions such as changes to the way air quality is presented

to the customers (UI), educating the customers, and also changing the logic behind feature notifications. Overall, I identified 8 options to be explored and prioritized.

Prioritizing

The final step in this process was to prioritize and narrow down on a recommended solution. To do this, I used the following table to communicate the options, the impact they would have, and whether they should be recommended.

Table 2: Prioritization Framework

Option *Description*	**Impact** *Pros/Cons*	**RICE Score**	**Recommended?**
Option 1	Do nothing	#	No
Option 2			
Option 3			

This table helped communicate the options to relevant stakeholders and quantified the value of each options using a modified R.I.C.E (Reach, Impact, Confidence, Effort). Note that it was common to include a "do nothing" option to understand the incremental value of each option. This exercise resulted in 3 recommendations: a p0 (critical) recommendation, p1 (recommended), and p2 (nice to have).

III. DESIGNED SOLUTION

As mentioned previously, this project was early in the product development process. The output of the project was an in-depth concept document that presented the background, situation, data, and recommendations for the Air Quality feature. This document was formally shared with the leadership team to align on the recommendations. The first recommendation outlined a firmware update from the sensor manufacturer. This was a clear P0 recommendation as the manufacturer presented convincing data that will meet customer expectations. Further, the effort required was relatively low and it could be tested in a field trial to understand the impact of this update (to be discussed in following section). The p1 recommendation was to introduce more complex logic to the feature that would match user expectations. This would address a separate expectation from the p0 recommendation and would complement one another. The high-level logic and product requirements were included in the document, but more detail is meant to be added in a PRD (product requirements document) to be created in the future. Finally, the p3 recommendation revolved around a new, unexplored, integration that would enhance the air quality experience and address some customer feedback. The impact of this option is difficult to assess, so it was recommended that more research be done on this matter.

IV. DESIGN VERIFICATION AND VALIDATION

Although this analysis was done at the conceptual level, there was still validation that needed to be done for each recommendation presented to leadership. First, I needed to validate that the

firmware update recommended was a feasible change to make. This was informally addressed during meetings but validated by reading documentation. Next, I needed to verify the accuracy of the data that I presented. Most of the metrics presented were obtained using custom queries from a variety of complex databases. I was able to walk through each query and metric with a member from the data science team. Finally, I needed to validate to see if the solution improves the customer experience! In other words – does this solution improve CSAT? Although my co-op ended prior to the implementation of the update, I was able to draft an Employee Field Trial (EFT) plan. This is essentially a formal way to roll out this update to company employees and obtain feedback to validate and verify that the solution is working as expected. It would also give visibility to see if it moves the metric to the target value (CSAT).

It is important to note the value of having multiple success metrics defined prior to conducting validation or verification. Other than a CSAT target, I also set more metrics that are specific to the behavior of the sensor and feature. For example, the number of notifications sent or the number of times that a customer see's "poor" air quality. These targets were all set based on the data analysis done on the current air quality feature. This helped us define success and gauge the effectiveness of each solution as the team shifted to implementation.

Overall, the engineering analysis resulted in 3 well-defined recommendations that answered the question of what the team should do to improve the Air Quality customer experience. These results are high-level recommendations and should be treated as such in the next step of the product development process. It is important for the team to follow through with the recommended testing procedure to evaluate the success of each recommended solution. This means that the solution requirements are subject to change based on field trial and research results. This is a normal and valid part of the iterative design process.

V. LIMITATIONS OF METHODS USED AND/OR DESIGNED SOLUTION

The solutions recommended have clear limitations. Firstly, the firmware update is provided by the sensor manufacturer. This means that although we have a high-level understanding of the change in logic and the impact on the feature, we do not have the ability to modify the update. This is limiting as any change must go through the sensor manufacturer which may increase the time it takes to make changes to the software. Further, the 2nd recommendation is limited by the sensor output. Although it includes changes to [undisclosed] logic, it is essentially based on the sensor output. Finally, the 3rd recommendation utilizes an open-source protocol that is subject to change. We would be limited by its functionality and subject to limitations that this tool may have (for example, response time). Despite these limitations, the 3 recommendations are designed to directly address customer feedback. These are the most effective and relevant options according to the engineering analysis and testing and iterating on these solutions using what we do have control over will be key to a successful implementation.

VI. CONCLUSIONS

The original question of this project asked what should the team do to improve the Air Quality customer experience? The answer to this question based on the above engineering analysis include 3 recommendations, in order of priority. First, it is recommended that the team launches an employee field trial (EFT) with an updated sensor firmware as soon as possible. Second, the team

should update the logic behind notifications to consider specific factors [undisclosed]. Finally, the team should explore introducing a new integration to add value to the feature and address customer feedback. Overall, the team has a clear and thorough set of recommendations that are based on customer feedback, real data, and the expected impact.

VII. RECOMMENDATIONS

The p0 (critical) recommendation is to launch an employee field trial (EFT) with an updated sensor firmware. The sensor manufacturer shared convicting data that shows an expected improvement in customer satisfaction. The cost is slim as it would require one firmware engineer to implement. Time depends on how different the libraries are. The expected benefit is a [undisclosed]% increase in CSAT.

The p1 (important) recommendation is to update the logic behind notifications to consider specific factors [undisclosed]. This will address many of the customer complaints found in the customer satisfaction survey. The cost is medium as more research and effort by a PM and engineer needs to be put into the new logic. However, this solution is expected to improve CSAT by [undisclosed]%.

Finally, the p2 (nice to have) recommendation is to explore introducing a new [undisclosed feature] to add value to the feature and address customer feedback. This is also a medium to high effort as it involves a new technology and additional market research. However, if done correctly, it could result in an increase in CSAT (estimate is TBD). It is recommended that this be treated as a “nice to have” considering that there are two recommendations that have a more clear and confident impact on the success metrics.

ACKNOWLEDGMENTS

The energy product team at ecobee, specifically the energy hardware team, was professional yet flexible. Their trust and mentorship made it possible for me to investigate the customer satisfaction survey and take the lead on one of the sources of detractor feedback. The team provided guidance and involved me in team meetings just like a full-time employee. The people involved in the product, firmware, marketing, and data science teams played a large role in the success of my project as well as my co-op.

REFERENCES

[1] “Smart Thermostats & Smart Home Devices,” ecobee, https://www.ecobee.com/en-ca/ (accessed Sep. 9, 2023).