User Needs, Benchmarking, and Requirements

Team Assignment

Team 307

# VOC Benchmarking

**Commercial Product #1:**

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Name: Ambient Weather WS-2902

Company: Ambient Weather

Website: [Link](https://www.amazon.com/Ambient-Weather-WiFi-Station/dp/B01N5TEHLI/ref=asc_df_B01N5TEHLI/?tag=hyprod-20&linkCode=df0&hvadid=216545230264&hvpos=&hvnetw=g&hvrand=13418822410054261917&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9030098&hvtargid=pla-350685252410&psc=1)

Keyword Search: Weather Station

Reviews:

| Voice Of Customer | Restated Customer Needs |
| --- | --- |
| Positive 5 Star Review:  “Received this unit Monday afternoon and started setting it up right away. I had a Acurite model before this one. It lasted about 2 yrs. Through no fault of its own we had a storm come through and it knocked out the sensor so it wasn't reading correctly. Overall I'd say this newer style model is much better so far. The color display is easy on the eyes although its much smaller then the one we had before. Reading the settings from an angle does seem a bit off but that's okay for us. Setting it up to Wifi takes a bit of doing and if you're not computer literate then it could be complicated. If you follow the instructions carefully you should be fine. Getting the batteries in the unit that goes outside was a bit different, It doesn't clearly show you in the instructions and you'd need to be careful not to brake something. The unit mounted okay with what came in the package because I had a mount from the previous model we had. Took about 5 minutes to mount. I would recommend this model its a step up from the Acurite model we had.” | * Weather Resistant (explicit) * Easy to read Results (latent) * Clear Set-Up Instructions (latent) * Accurate Measurements (explicit) |
| Negative 1 Star Review:  “I was so excited to get this a a Father's Day gift. I proudly installed it in our backyard and removed the old plastic cylindrical rain gauge from Tractor Supply. After several huge rains we had here recently I would notice that the rain gauge would register .2 inches when we obviously got over 1 inch of rain. I also noticed during storms the wind gauge which was spinning so fast you could not see the cups, was only registering 8.3 mph maximum. So i got the hose out and put it on a light sprinkle mode. Let it run for 15 minutes. Daily rain registered 0. All that water falling through the cup and not registering a drop. So I took my Ryobi leaf blower (550 cfm) that puts put a tremendous amount of air and got those three cups spinning as fast as I could. Air comes out at over 100mph. Gauge showed 38mph even after several minutes of trying. Now I don't even trust the barometer (i can't test it). The only thing that seems to work is the temperature and humidity setting. Awful expensive for $170. I called and talked to customer service. They instructed me to remove the unit, remove the batteries, cover the solar panel. Let it sit for two hours, reinstall the batteries and press the restart for 1 minute. I did all of that, re-leveled and set the unit to north knowing/hoping it would work. I retested after we recently had a rain storm and the gauge read 0" for the day. It is still messed up. I am a little miffed, I actually believed them. I would love to return it, but it is over the 30 day period for Amazon. The return policy on their website is not easy to meet the requirements of ALL original packaging. So it looks like we got scammed. Don;t buy this product. I don't usually write reviews, but I do want to warn the unsuspecting customer who believes "The highest rated personal weather station" advertisement. I am sure there is something that has a longer track record out there that this contraption. Ambient Weather will not be around long as a company.” | * Accurate Measurements (explicit) * Low Price (latent) * Ability to test the product themselves (explicit) |

**Commercial Product #2:**

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Name: Tempest Weather System

Company: Weatherflow

Website: [Link](https://www.amazon.com/Tempest-Weather-Accurate-Forecasts-Wireless/dp/B0868WY7NY/ref=sr_1_3_sspa?c=ts&keywords=Weather+Stations&qid=1674000709&s=lawn-garden&sr=1-3-spons&ts_id=397435011&ufe=app_do%3Aamzn1.fos.c3015c4a-46bb-44b9-81a4-dc28e6d374b3&psc=1&smid=A3RAYC554RKGF9&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUFNUkw5MTRPQVZMSVMmZW5jcnlwdGVkSWQ9QTA5MjEwOTNWNUFXU1JLN09aVEUmZW5jcnlwdGVkQWRJZD1BMDQxODk1MTJBRFZOTDExQ0JFOFImd2lkZ2V0TmFtZT1zcF9hdGYmYWN0aW9uPWNsaWNrUmVkaXJlY3QmZG9Ob3RMb2dDbGljaz10cnVl)

Keyword Search: Weather Station

Reviews:

| Voice Of Customer | Restated Customer Needs |
| --- | --- |
| Positive 5 Star Review:  “I was skeptical about some of the claims of their new way of monitoring weather conditions (acoustic wind detection, haptic rain sensing). I have only had the unit installed for two weeks, but all I can say is thus far, blown away. I haven't had connectivity loss as frequently (admitted low sample set), and the lightening detector is nothing short of magic.  What impressed me the most was the weather forecast capabilities. Again, I don't have much of a duration to feel confident this was "lucky", but this PWS predicted rain (70% - 80% chance) that actually materialized about 5 days out, when no other app forecasted the rain until 48 hours or less (Weather Channel, etc). I live in an area where there is no other Tempest PWS in close proximity, so I will not benefit from aggregated sample sets to improve the forecasting, but thus far, it doesn't seem to matter. Whatever sources they are compare/contrasting against seem to be producing results. Let's see.  Set up and installation was shockingly easy and I like that they eliminated the common separate information panel which I found only partially useful now that I have their proprietary app on multiple devices and can easily check the conditions (as well as my wife can too). This was a HUGE shift in product development in my book. I'll be interested to see how well it holds up to the elements compared to the AccRite unit that I had which had spinning parts and a rain gauge that needed cleaned out from time to time (leaves, debris stuck in the cup).  Bottom line, highly recommend this product. Super impressed.” | * Extra Measurements (latent) * Not losing connectivity (latent) * Ability to forecast (explicit) * Easy Installation (latent) |
| Negative 1 Star Review:  “I bought the Tempest specifically because the Amazon description said that it works by Bluetooth even if the internet is down. However that is not true. In the picture below, the left side is connected to the internet. The right side is Bluetooth 30 minutes later. As you see none of the data updated at all. Tried closing the app and reopening it, no change. Wanted it to use while camping. I’ll be returning the unit. Shame as I really like it.  Next it appears that the station is dependent on the web. Not only to access the cloud, but for "data processing" So you never really know if the data displayed is from the station, or processed to match other weather data from somewhere else. If that is the case, what is the reason for the station? I can get weather data from a million sources on the internet with out a station.” | * Bluetooth connectivity (explicit) * Able to work without internet (latent) * No false claims (latent) |

**Commercial Product #3:**

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Name: Iris

Company: AcuRite

Website: [Link](https://www.homedepot.com/p/AcuRite-Iris-5-in-1-Wireless-HD-Home-Weather-Station-with-Wi-Fi-to-Weather-Underground-Remote-Monitoring-Built-In-Barometer-01208M/310331674#ratings-and-reviews)

Keyword Search: AcuRite

Reviews:

| Voice Of Customer | Restated Customer Needs |
| --- | --- |
| Positive 5 Star Review:  “ I never had one and It's super easy to install and setup! It consists of 2 main parts. The wireless monitor and the actual sensor that stays outside. You can connect the monitor to the internet and submit your weather station information to Weather Underground. Also, you can download forecast from Dark Sky. The monitor also reads the indoor temperature of where it's located. You can buy an additional lighting sensor to get lighting distance and other info. It's fun and easy to read!” | * Simple set up and install (explicit) * Reads indoor temperature as well (explicit) * Easy to read results (latent) |
| Negative 1 Star Review:  “I had trouble getting it set up and couldn't get it to connect with my internet. Then the screen kept shutting off and restarting over and over, so I had to return it.” | * Able to connect to the internet (explicit) * Product to stay on without shutting off or restarting (latent) * Simple to follow setup (latent) |

**Commercial Product #4:**

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Name: Digital Color Weather Station

Company: La Crosse Technology

Website: [Link](https://www.homedepot.com/p/La-Crosse-Technology-Digital-Color-WI-FI-Professional-Weather-Station-with-Wireless-Wind-and-Rain-Sensors-Plus-Bonus-Display-V22-WRTH-INT/305588712?)

Keyword Search: Weather Station

Reviews:

| Voice Of Customer | Restated Customer Needs |
| --- | --- |
| Positive 5 Star Review:  “This weather station works perfectly for me. It appears to be accurate and is very easy to read. The physical installation went well and only took a short amount of time. The only problem that I had was with the app used for setup. Through trial and error, I finally discovered that it is necessary to temporally disable the 5 GHz WiFi band on my router for the network setup to work. Unfortunately, there is nothing in the instructions saying to do this. After the setup finished, I then re-enabled the 5 GHz band on my router and now everything works perfectly.  by” | * Accurate Data (explicit) * Accurate instructions (latent) * Strong WiFi connectivity (explicit) |
| Negative 1 Star Review:  “At some point you will deeply regret getting involved with this company. I had this device for about a year and aside from the fact this device is incapable of handling daylight savings without resetting to factory defaults, things were working well. Then a wind and rain sensor both died and that is when it all went downhill and you will learn quickly that La Crosse support is non-existent and it seems like 3 person operation. It takes many attempts to get a single reply via email and the response is weeks later. I ended up buying 2 more wind sensors one refurbished, one brand new and neither will report wind speed to my base station despite doing every single suggested fix on the internet. If you call for support, them it goes to voicemail. The one time i got someone on the phone she was very nice and said she would refund me for a wind sensor since I bought more under warranty but that refund has yet to happen ..or maybe that takes many weeks to accomplish as well.” | * Able to change the time for daylight savings (latent) * Easy to replace parts that die or break (explicit) * Customer service (explicit) |

**Commercial Product #5:**

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Name: WM-5

Company: Ambient Weather

Website: [Link](https://www.amazon.com/Ambient-Weather-WM-5-Windspeed-Temperature/dp/B00E80E7JS/ref=sr_1_3_sspa?keywords=handheld+weather+station&qid=1674001737&sr=8-3-spons&ufe=app_do%3Aamzn1.fos.f5122f16-c3e8-4386-bf32-63e904010ad0&psc=1&smid=A2ANVX7C75D1I&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEzSUdQWkFUMUgyR0FKJmVuY3J5cHRlZElkPUEwMjQwNzE0MkhUWFlaM09aRThZRiZlbmNyeXB0ZWRBZElkPUEwODU3MzQxMlVEVFhTTzBPSDNaNyZ3aWRnZXROYW1lPXNwX2F0ZiZhY3Rpb249Y2xpY2tSZWRpcmVjdCZkb05vdExvZ0NsaWNrPXRydWU=)

Keyword Search: Mobile Weather Station

Reviews:

| Voice Of Customer | Restated Customer Needs |
| --- | --- |
| Positive 5 Star Review:  “I've used this for a few years now and it's still running strong. At just under 4oz, it goes with me nearly everywhere camping and hiking. The display has a lot of small characters, so if sight is a problem, you might look elsewhere. Otherwise, it's got a rich set of information that should satisfy everyone.  The batteries don't last as long as I'd like, though I can't say that I've tested the number of hours one will last; my only caution is to not leave it running for hours or days at a time and always have a spare.” | * Easy to move from location to location (explicit) * Clear Display (explicit) * Long Battery life (explicit) |
| Negative 1 Star Review:  Had to return. Bought to use when traveling in motorhome. This is meant for hiking or camping, not for traveling. The setup for each use is complicated and the display is so small it is difficult to read settings or change displays. Elevation calculation requires daily calibration if you change locations and elevation max's out below the height of many mountain passes.” | * Clear Display (explicit) * Simple Set-Up (latent) * Able to easily change settings (explicit) |

# Organization Table 1

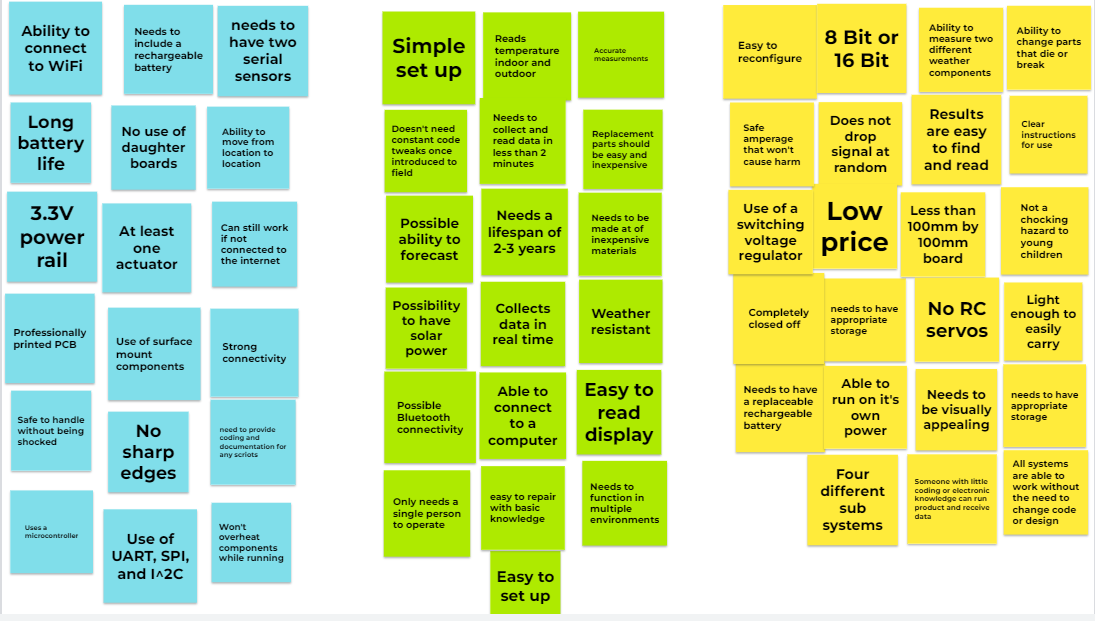


Table 2

Yellow = 1 Star, Green = 2 Star, Blue = 3 Star



Table 3 Organized and grouped by color



# Developed Requirements

Embedded Design System Project

Team 307

Engineering 314 Class

Project Manager: Connor O’Hara

Date of Creation 1/17/2023

Version 1.0

## Introduction

The Innovation Showcase is an event held at Arizona State University for upper divisional engineering students that showcase their final project to their professors and stakeholders as well as other students that visit and public. The main focus of this event is to explore what engineering students have developed over the course of the semester and see how they apply the knowledge they have gained and infuse it into a functional design. Specifically for Engineering 314 students, their project is to produce a system that interacts and corresponds with the environment and is required to use serial sensing and actuation. Another requirement is that their project/design must broadcast their environmental data using WiFi using the MQTT protocol. Students must include a design that senses at least two environmental conditions and two separate serial sensors. It is also required in the plan to include at least one motor controlled by a motor controller over I2C or SPI-based protocol. The working product of the engineering groups will be presented at the showcase on April 28th, 2023, and will be evaluated by professors for correct functionality as well as meeting the course requirements.

## Objectives

The primary goal of our team is to create a simple yet robust, hands-on design that allows the user to detect a change in temperature in an environment as well as detect the humidity levels in that same environment and display the data on an LED screen. It is important to the design to maintain a focus on inexpensive and reusable materials for the modular components that will be used by the user. Our group's belief is that simple and inexpensive parts and presentations will lead to an impactful learning course for all users that come across our design. Our focus is that anyone of any age and language background could easily pick up the device and understand how to use the system. The final product will consist of two sensors which will allow the user to interpret two environmental conditions and display that data on the screen to the user.

## Stakeholders

**Professors**- The Primary Stakeholders for this project, in charge of looking for and determining the design and project meets expectations. Looking for new and exciting ways for groups to apply their knowledge in their designs and product. Looking for products that sense two environmental conditions while using two sensors. Will disqualify a project if the group is using preexisting products.

**Showcase Visitors**- Public viewers and ASU students that are interested in different products and/or new technologies that they can observe and increase knowledge of current and future environmental data suppliers.

**Volunteers**- Individuals that interact with research teams as well as visitors and provide information, tutorials, and important safety and guidance.

**Research Teams**- Scientists and engineers that are looking to discover new ways to explore how to interpret temperature or other weather-related information. Their research focuses on engagement in interests, identity, and exposure.

## Use Cases

**The Visitor**: An outside visitor hears of the showcase that focuses on products that interact with environmental weather conditions and is intrigued. This visitor is constantly outdoors and sometimes in harsh conditions. He/She is looking for something that will be small and compact and sturdy enough to handle severe weather conditions.

**Hiking Interaction**: This hiker has borrowed a prototype of our product and puts the design to the test when they go on week-long hiking trips. They utilize the device by checking what the temperature is outside and reading off humidity levels in the environment that they are in.

## Aspects

1. **Product Design**

The product research and design will focus on materials that will correctly determine weather conditions while maintaining an inexpensive design.

1.1 The product shall contain materials that are inexpensive and easy to find.

1.2 The product shall consist of at least one motor.

1.3 The motor shall be controlled by a motor controller.

1.4 The product shape should be small enough to fit in a pocket or a small bag.

1.5 The product shall consist of materials such as plastic and metal.

1.6 The product shall be weatherproof.

1. **Software/ Functionality**

2.1 The Product shall function in harsh environments.

2.2 The product shall interpret two or more environmental conditions.

2.3 The product shall function based on coding and allow for motors to operate between different speeds

2.4 The product shall Sense with two separate serial sensors.

2.5 The charger shall provide 12+ hours of operation usage.

1. **Interactivity**

3.1 The products shall be designed to withstand damage and accidental drop age

3.2 The software shall be easy-understanding software for any user.

3.3 The product shall be available for any age.

3.4 The product shall have little to no assembly necessary.

3.5 the product shall consist of buttons to swap between data points.

1. **Customization**

4.1 The product sensing parts shall be interchangeable.

4.2 The product should have the ability to change between different weather conditions.

4.3 The product shall be appealing to all age groups.

4.4 The product shall be used for more than one scenario.

1. **Manufacturing**

5.1 The total cost of the product shall be less than $100

5.2 The materials of the product shall be inexpensive and easily accessible.

5.3 Materials need to be sturdy and lightweight.

5.4 The product shall only take 10 minutes to build

5.5 The product shall not follow concepts of existing projects.

1. **Safety**

6.1 Protective gloves will be provided

6.2 Protective eyewear will be provided and mandated depending on the materials that are being used.

6.3 Electrical components must be at a safe voltage.

6.4 Any sharp objects will be facilitated.

## Open Questions

* Will the battery be replaceable or rechargeable?
* Can we improve the battery life and reduce the amount of battery recharge?
* Are there better materials that can be applied to the product other than plastic while still remaining cost-effective?
* Can we improve on the customization of the software so the user can choose what environmental condition to focus collecting data on?

## Milestones

* Concept Presentation: 1.23.2023
* Design Presentation: 3.17.2023
* Design Freeze:4.24.2023
* Planned Release: 4.28.2023

## Resources

<https://www.dropbox.com/s/n0lc8p5tui8sxyd/doc-project-description.docx?dl=0>