User Needs, Benchmarking, and Requirements

In the initial phase, our team conducted extensive research by analyzing user comments on various online platforms related to existing weather stations. By delving into forums, product reviews, and community discussions, we gained valuable insights into the experiences, preferences, and challenges users faced with current weather stations. These online user comments were systematically organized, and recurring themes were identified. This meticulous organization allowed us to distill common needs and concerns expressed by users.

The collected data was then meticulously organized by identifying common themes and patterns in the user feedback. Needs were categorized into distinct groups such as functionality, usability, durability, and connectivity. To ensure a targeted approach, the team prioritized these needs based on their perceived significance to users and alignment with the overarching project goals.

User Needs

- EXPLICIT - Small
- LATENT - Lightweight
- EXPLICIT - Easy to use
- EXPLICIT - Easy to install
- EXPLICIT - Automates a task
- EXPLICIT - Internet connectivity using MQTT
- EXPLICIT - Easy to maintain
- EXPLICIT - Portable
- EXPLICIT - Easy to integrate with existing systems
- EXPLICIT - Durable
- EXPLICIT - Able to withstand high temperatures (43C)
- EXPLICIT - Able to withstand low temperatures (1C)
- EXPLICIT - Self sufficient
- EXPLICIT - Notifies when maintenance is required
- EXPLICIT - Resistant to high winds speeds (haboobs)
- EXPLICIT - Low power consumption
- EXPLICIT - Easily replaceable parts
- EXPLICIT - Alerts about certain conditions set by the user
- EXPLICIT - Track certain conditions
- EXPLICIT - Record certain conditions for usage
- EXPLICIT - Records are easy to obtain
- EXPLICIT - Follows environmental regulations
- EXPLICIT - Waterproof

- EXPLICIT - Any speed settings should be able to be modified
- EXPLICIT - Self Calibration features
- EXPLICIT - Able to process certain calculations inputted by user
- EXPLICIT - Language options if there is an interface
- EXPLICIT - Cohesiveness
- EXPLICIT - Surface mount components
- EXPLICIT - Must use I2C or SPI for communication between sensors and actuators
- EXPLICIT - Scalable
- EXPLICIT - Backup power source
- EXPLICIT - Time stamps for weather data
- EXPLICIT - Manual testing and debugging features
- EXPLICIT - User manual
- EXPLICIT - Dust prevention
- EXPLICIT - Ability for software updates
- EXPLICIT - Users need the option to export data to cloud storage services
- EXPLICIT - Resistant to corrosion
- EXPLICIT - Compatible with 5Ghz Wi-Fi connection
- EXPLICIT - The system should be designed to minimize environmental impact
- EXPLICIT - Low latency response for critical weather events
- EXPLICIT - The mobile weather station should have a built-in GPS for location tracking
- EXPLICIT - The system should provide real time alerts for varying weather conditions
- EXPLICIT - The system should integrate solar power options for energy sustainability
- EXPLICIT - Robust and durable housing to protect internal components
- EXPLICIT - The motor controller should have a safety feature to prevent overheating
- EXPLICIT - Code Written in Python or C
- EXPLICIT - Backup data storage option in case of internet outage
- EXPLICIT - Option to read humidity
- EXPLICIT - Option to read wind speeds
- EXPLICIT - Support integration with smart home systems
- EXPLICIT - Weather resistant cover
- LATENT Aesthetically pleasing to look at
- EXPLICIT - Option to read temperature
- LATENT - Color scheme matches environment
- EXPLICIT - Cheap (under $180)

- LATENT - Materials and colors chemically safe for animals
- LATENT - Clear and legible screen under different lightings
- LATENT - Compatible with a variety of devices

Voice of Customers Benchmarking

Search #1

Keywords: Gas Sensor

- Price: $149.99
- Vendor: Amazon
- Description: An indoor Air Quality Meter Monitor that measures Gas 0~100 PPM, Relative Humidity and Temperature, Rechargeable Ammonia Gauge with Alarm, Backlit LCD Display..

Positive Comments

Voice of the Customer	Restated Customer Need
This ammonia gas detector can accurately detect gas/ammonia while also keeping track of the temperature (both C/F) and humidity. It has a tripod mount port so you can mount it and have it continually monitor things to get an accurate reading of change in the same spot. The case could be better, but it gets the job done and the detector works great.	Accurate gas detection-Explicit Stable and continuous monitoring via tripod mount-Explicit Environmental monitoring of the humidity and temperature-Explicit
This is a good gas detector. Seems to be working correctly. Not hard to use. Seems to give me good readings. The case is made out of a hard plastic and is wrapped with a shock absorber hard rubberized type material to protect it against drops. I still would take precautions against doing so. Seems to be well made. Does come with directions for use. I do like how the detector comes with a temperature and humidity screen. The only complaint I have about this is the case. I	Durable and protective case-Latent User-friendly operation-Explicit Enhanced aesthetics for quality perception-Explicit

mean for a quality detector there should be a quality case to put it in. Come on now. For something of this value it should be finished off with a great case. If it wasn't for that I would give this 5 stars.	
This meter works well and has the same ammonia reading as the five gas meter we were using. The readout is hard to see in bright sunlight but is great inside silos.	Readout visibility in varying lighting conditions-Latent Effective usage in specific environments-Explicit Accurate ammonia reading-Explicit

Negative Comments

Voice of the Customer	Restated Customer Need
Product worked great for 7 months. Then stopped charging with just a red blinking light. Expensive given the short life cycle.	Reliable and long lasting performance-Explicit Effective charging mechanism-Latent Value for money and durability-Explicit
It does what it is supposed to do. Unit doesn't last long, though. It's made pretty flimsy. Definitely the best price you'll find	Durability and longevity--Explicit Affordability--Explicit Functional performance-Explicit
While the product initially performs its function, I've noticed a significant decline in its effectiveness over time. The build quality is questionable, and the unit seems prone to wear and tear. Despite the seemingly attractive price, the short lifespan and deterioration in performance make it less appealing in the long run.	Reliable long-term performance-Explicit Durable-Latent Performance over cost-Latent

Search #2

Keywords: Weather Station

- Price: $189.99
- Vendor: Amazon
- Description: A Wireless all-in-one integrated sensor array. Measures wind speed/direction, temperature, humidity, rainfall, UV and solar radiation.Supports both imperial and metric units of measure with calibration available and has enhanced Wi-Fi connectability option that enables your station to transmit its data wirelessly to the world's largest personal weather station network

Positive Comments

Voice of the Customer	Restated Customer Need
The item was well packaged and first impressions right out of the box were positive - it has an actual owner's manual, felt durable, and had protective wrapping around everything. I had no issues connecting the sensor array to the console, and no issues using the "awnet" app to connect the console to the wifi router/internet (Ambient Weather Dashboard, Weather Underground, and PWS.com). Once that was all complete, I needed to mount the array outside. Now, I live in an urban area & in an apartment. After toiling around with where & how to situate the sensor array, I decided on what's indicated in the picture. While I find occasionally that the wind & solar measurements are curtailed due to nearby homes (which I knew before buying it), the temp and rain are always right in line with other nearby wx stations (including Davis ones). Plus, this setup is mobile, non-permanent, and easily accessible. Accuracy is hugely important to me. You can have a $500 station and have it report bad readings, so for 1 month after the array went "live", I recorded daily high & low temps of all nearby Weather Underground stations within 2 miles. Safe to say, my WS-2902a was right in line with all other stations - between 0-2°F difference, most times within 1°F. The rain, UV Index, Solar Radiation were also accurate, so much so that I stand by my WS-2902a's readings whenever I need to report to the NWS for storms. I was afraid that the temp sensor would be too warm in the sun and the warmth reflecting from my apartment building would get picked up from the temperature probe - I was wrong. The solar shield works fantastically! I doubt when summer comes with the	**Accurate and reliable measurements**-Explicit **User-friendly setup and connectivity**-Explicit **Responsive customer support and regular updates**-Explicit **Mobile accessibility and data viewing-Latent** **Comprehensive measurement sensors**-Explicit

heat & high sun angle that that will change. With all of its measurement sensors (temp w/ dew point & humidity, wind speed, wind direction, rainfall, UV, Solar, Pressure, and indoor temp-dew-humidity) combined with their accuracy, it's an extremely well-priced unit. All my data can be viewed on Ambient Weather Dashboard online or in their app, and if you don't like that there's PWS.com and Weather Underground which record your data in 5 min intervals, but display live readings quicker than that. You can even export your data to excel to make graphs. Mobile access is wonderful. Also, I can't say enough about the CEO Ed Edelman. He is countlessly answering my questions - he's super fast to respond and gives you honest & direct answers (no BS like other companies). And he's quick to release update fixes to the station's firmware and AWDashboard when customers report issues. There's even a FB group for Ambient Weather device owners, which serves as an additional tool to receive input from other owners in the group. Best customer experience I think I've ever had, and I know others can say the same. Sure, there are small things about the WS-2902a that I've noted that could be improved, but nothing drastic. I'd like increased customization of the AWDashboard (manually moving tiles around, more computed data displayed like "Today's Max UV Reading"). I also wish the display cycled through other measurements (Dew Point, Wind Chill, Heat Index, Max Daily Gust), but you can view that online and/or you can buy the WS-2000 console for that and for better all-around viewing angles and you can even add up to 8 additional temp/humidity/dew point sensors.	
I have a lot of fruit trees in my backyard plus a rose and lavender garden. Wanted to keep on top of local weather conditions so if needed I could protect my plantings from cold etc...I decided to go with Ambient Weather's WS-2902 D. It includes a temperature module, anemometer, wind direction, wind speed and rain gauge. The most time consuming part of installation was the mount itself. The instructions for mounting the weather station to the top of a mast are well described and a simple job of attaching the U Bolts with screws and using the bubble level (built in to the top of the unit) to keep the device level. You must make sure that the arrow embedded on top of the hard plastic of the unit is pointed exactly to the north. Double check that. I used a compass app on my phone. Worked great. I chose to mount my station on 1.5" PVC pipe. Yes, they recommend steel but go out and try to price that! Ridiculous. The weather station accepts 1.25-2 inch pipe. My 5 foot section was installed on a deck support with the help of an antenna mounting kit purchased on Amazon. Hard steel and strong U Bolts. That thing is screwed in for life. The only drawback with PVC is the wind. This can cause movement of the station affecting readings. I am a ham radio operator and used an identical 1/8" black rope (parachute like cord) that I have hanging a wire dipole between 2 trees on my property. For the weather station I made 3 guy rope supporting lengths that you can see	**Sturdy mounting and stability**-Explicit **Solar powered and battery backup**-Explicit **Accessibility for maintenance purposes**-Explicit **Intuitive console display-Latent**

in the picture. There are two in this picture. I put in the 3rd down at ground level a few days later. Now, there is no and I mean NO movement of the pole with high wind gusts. The height of the deck plus the pvc tubing puts the weather station at 18 feet above the ground. There are two caveats: Make your weather station accessible. You have to clean out the rain gauge apparatus every couple of months plus swap out batteries; so you do not want to kill yourself dangling off of a ladder. BTW, the unit is powered with a solar cell built into the top part of the station. Batteries are used when there is insufficient daylight. The weather station immediately connected with the base unit. I have the console sitting on my home office desk. Connecting the unit to wifi and weather underground, weather cloud and the Ambient site take time but well worth it in the end. I periodically check other units in my neck of the woods on the Ambient website. The console display is well laid out and easy to see all parameters. It is pretty intuitive trying to figure out what button does what but it is a good idea to read through all the instructions. The display also shows UV light, light, phases of the moon, indoor temp and humidity, outdoor temp and humidity, rain amounts, wind speed and direction, date, time. There are signal strength connecting bars (mine have a solid 5) that show the quality of the connection between the station outside and your console. These are located about half way across the top. There is your typical wifi connection strength indicator at the top right of the display. I am quite satisfied with the entire system. It does it all. The only thing it doesn't do is pour me a nice glass of port at dinner time!	
I bought this one to replace an older Davis Vantage Pro2. The Davis station and its sensor are considerably heavier duty than this Ambient station. My reason for replacing the Davis was that the Davis could not connect to the 'net except through a computer running WeatherLink software -- all of which regularly crashed. Yes, I know there is a wireless device that can be installed inside the Davis that is supposed to send data wirelessly to a router then to the 'net -- I tried that, instructions were horrible, tech support of no help, sent it back for refund. This weather station went together in a few minutes, everything worked right out of the box. I downloaded the WeatherLink app to my iPhone and followed the instructions to detect and set up the wireless that is part of the weather station. After about 10 minutes of fiddling around with it, the station sensors -- 125 feet away on a 20-foot tall post -- are talking to the console; the console is talking to the 'net through my wireless router; and my station is reporting on both AmbientWeather and Wunderground	**Compatibility with mobile application**-Explicit **Reliable wireless connectivity**-Explicit **Effortless configuration**-Explicit

Negative Comments

Voice of the Customer	Restated Customer Need
Cons: * It comes in a million pieces - including extra pieces that apparently do go with the unit? A weird spring? (see pic) See UPDATE below in next item. It took a while, but I found out what it was. It's not in the huge manual. * The instruction booklet is really awful and refers to items that don't go with this unit - NO instructions for extra pieces or even acknowledgment of them in the list of pieces (spring for example) UPDATE: Don't look for instructions - but I found info that it is poked into the center of the rain funnel to work as some sort of filter.. but it doesn't work. It just slows the rain from going down the funnel and doesn't stop any debris - at least not so far. So - stays in the CON pile. * The instructions to connect the unit to wifi via your smartphone is HORRIBLE and doesn't work. If you're purchasing because it offers "wifi" buy something else. They don't provide an easy install QR or anything. It's just soooo much harder than it should be. Note: The flashing wifi symbol DOES stop flashing, contrary to what the "in the know" tech support expert" told me. The fact it stops flashing is good and should be in the PRO column, but it's not enough to turn the tide here. Now, if you are a professional tech support person who specializes in wifi connectivity, you MIGHT succeed - but I would not lay money on it. * The app is completely useless - I live relatively rurally. So it would not register my address. Instead, I was given a choice to choose someone else's address(es) all more than 30 miles from me for weather checks. What??? Yeah, the app is junk. Note to self... check the app BEFORE purchasing the unit. My bad. * There is a tag in the box that offers an email and phone number for customer service. I tried the email. I sent the pertinent info regarding my phone, type etc.. all the things I had tried... etc. First response from the email was... " What kind of phone are you using?" O.M.G. Don't bother unless you enjoy the frustration of someone representing customer service but really has no idea what they are doing. * It does NOT come with a post of ANY kind - so purchase one. Also, NO batteries either. * The indoor unit is great if you set it down and don't touch it. If you accidentally touch the bottom edge, you'll have to reset it at every point. GRRRRR * Speaking of setting it down, it has some pop out legs AND a base that apparently do NOT work together. Good luck. I have yet to figure out a solid way to set it. Conclusion for me.... I am looking for a different station. I don't care about the wifi part, so I'll be looking for something less technical maybe. It would be so nice if it didn't come in a million pieces and just worked. I purchased this one to replace a cheaper one that only lasted 9 months. Maybe I am meant to watch the TV weatherman. UPDATE: 11/30/2020.... So, I haven't owned this weather station for a month and now the outside temp and light monitor no longer report to the inside unit. This thing is a very expensive piece of junk. If I could drop to ZERO stars, I would.	Simplified assembly process-Explicit Comprehensive instruction booklet-Explicit Clear and legible screen under different lightings-Latent

So, I purchased this for my father, who recently passed away. I decided to take it and set it up at my house because we used to love to chat about the weather. The "buttons" are just bad, touch sensitive membrane keys. If you accidentally hit the set button, it will display the mac address of the unit. Now if you are a network engineer by trade (as I am) this is nice, but it is not at all clear how to get back to the normal display (hint it will revert after about 30 seconds or so) via the device itself. The WIFI setup is the stuff of nightmares. Being a network engineer, I have multiple iOS and Android devices. There are two different apps for setup, one for Wifi setup and another for looking at device data. Why this is a thing in 2023 is beyond me. The device does not support 5 Ghz WIFI which I could give them a pass on. I fiddled with both the Android version and IOS versions trying to get the WIFI to set up properly to no avail. the iOS app just flat-out crashed. Android does not crash but the setup dance (i.e. join local WIFI network, join device broadcasted network) is saddled with terrible UX/UI and flat out does not work. Looking at both the manual and online help guides, both have unclear steps, spelling mistakes, etc. With all the above I wanted to point out in the interests of fairness that you do not need to establish a WIFI connection to use the devices basic functionality. It's used to link other services, upgrade firmware etc. It will read data from the sensor platform without setting up a WIFI connection. I wanted this review to exist because if you are buying this for someone less technically inclined stay away from it or you will be stuck with a device that does not allow its full functionality due to a bad software stack or worse, supporting people trying to get its wireless functionality to work (good luck).	Compatibility with 5Ghz Wi-Fi connection-Explicit Support for basic functionality without Wi-Fi-Explicit Technical support for users-Explicit
When I received my weather station, I was all excited. Then reality hit when the only readings that were accurate were time, date and phase of the moon. Not a single weather reading was close to accurate. I've performed all the calibration steps, and have most things reasonably close. Except one. The Rain Gauge. Ambient calibration instructions require a minimum 4 inch wide calibrated rain gauge. I don't have one, and no luck finding one that a homeowner can afford for a one-time use. So I emailed Ambient tech support and explained the situation. I asked them for what one cup of water, poured into this model (WS-2902C) , how much rain would the display show. Ambient Tech Support responded "they do not have that info". Nothing else. Well, hmmm. OK. Since they are the manufacturer's Tech Spt, I assume they would have one of these stations set up and in use. So I replied back immediately and asked him if he would be so kind as to perform the experiment (just pour a cup into the rain collector) and let me know what the display reads. I also told him I'm just a homeowner, I'm not using this for some scientific study. This might be a great way to help customers in the future! Ambient Tech Spt (yes, I have the guy's actual name) replied he was too busy to help me at this time ! What ??? !!!.	Accessible calibration process-Explicit Affordable calibration tools-Explicit Transparent product limitations-Latent

Incredible. So I waited a week (yes, I try to be patient), and sent another email. once again asking for help with the reading for 1 cup . .or any other measured amount of water. Instead I receive back an engineering formula. Last night I received an official reply from Ambient thru Amazon message service on the problem that basically tells me the same thing as the manual. .. use a calibrated rain gauge (minimum 4" wide) to get an accurate reading, and then calibrate the station. So I'm back to square 1. Folks, the weather station looks pretty, but honestly, go find one from a manufacturer that actually cares about supporting their product for everyday homeowner customers.	

Search #3

Keywords: Portable Weather Station

- Price: $339.00
- Vendor: Amazon
- Description: A small portable weather station that measures temperature, solar radiation and UV, humidity, barometric pressure, wind speed and direction, dew point, lightning strikes and rainfall.

Positive Comments

Voice of the Customer	Restated Customer Need
I had a Davis weather station for a couple years and then it broke. Calls to their technical support or no help. They were insisting that device was working properly, but it wasn't reporting any temperature. From there and they couldn't see any problem with it. After spending a lot of time trying to get it to work without success somehow I was lucky enough to come across information regarding Tempest. This device is so simple to install and configure. I can't imagine a better design. I called the technical support with one question actually before I brought the product and got someone to answer within two or three rings. The app is very elegant and very modern looking. Provides all the data that I was seeking. I cannot imagine about a device especially at this price but possibly at any price.	1. User-friendly installation and configuration-Explicit 2. Effective device operation-Latent 3. Transparent and accessible information-Explicit
I bought this to replace a different station that caused me nothing but connection problems. I was hesitant to buy this one because of the cost, but I'm glad I did. Setup was simple, and the amount of information this station provides is amazing. Comparing it to local weather stations and even Apple and Alexa weather shows that this is very accurate.	1. Accurate comparison with other trusted sources-Explicit 2. Durable construction-Explicit 3. Provide useful information-Explicit

The station is solidly built and I have little worry that it will not last for years to come. I was surprised that the weather map showed so many other Tempest stations nearby. Evidently, I am not the only one who has recently purchased one. I'd highly recommend	
I live in the Lower Peninsula part of Virginia where the microclimate constantly screws with my Rachio irrigation controller's weather intelligence. It's not uncommon for it to be raining heavily a quarter mile from away while it's sunny here or vice versa. This year the Rachio's weather intelligence "saw" significantly more observed rainfall than actual and ended up skipping a large number of scheduled watering days. This combined with frequent temps over 90 degrees made for an extra crispy late summer lawn. I split my time between VA and MA so it's not all that easy to tell if the lawn is getting the right amount of water when I'm away. By the time I got back a couple of weeks ago the lawn was in pretty tough shape. I've had my eye on the Tempest for a while now and the recent direct integration with the Rachio made it a no-brainer decision. The integration seemed simple enough (select "Add Device" in the Rachio app, select "Tempest" and enter a 6 digit integration code) but a number of Amazon reviewers complained that it was difficult/impossible to get the code from WeatherFlow or Rachio and WeatherFlow's on-line community also had a number of posts complaining about the process.	1. User-friendly troubleshooting-Explicit 2. Addressing community feedback-Latent 3. Clear communication on integration steps-Explicit

Negative Comments

Voice of the Customer	Restated Customer Need
Rain Data is random (Actual Rain this year from two calibrated manual rain gauges: 49.64" .Tempest Reported: 27.01 inches.) Temperature during the middle of the day is reported 3-4 degrees below the actual air temperature. We haven't checked wind speed or humidity. But at this point it would be a miracle if they are even close. Technical support is non-existent. We supplied the detailed rain data. Emailed and called multiple times for their ("calibration" support) and they never responded even after we were told the support request was elevated to engineering.	1. Accurate rainfall data calibration-Explicit 2. Temperature calibration for precision-Explicit 3. Comprehensive humidity verification-Explicit
We own a ranch in the Texas hill country and needed a way to keep our animals and gear safe from adverse weather so we bought the Tempest in Oct 2023 because of the positive reviews. Right away I could tell the rain and wind accuracy were way off based on other stations and the weather around us. BTW, the station is mounted 50 yards from any obstruction and has full sun. Contacted the manufacturer and they rebooted the system and said everything was better. Regularly me and my neighbor	1. Temperature accuracy in extreme conditions-Explicit 2. Optional sensor placement guidance-Explicit 3. Open communication on improvement feedback-Latent

who also has a Tempest will have standing water showing no to little rain as well as having 50 mph wind gusts that only showed mid twenties. Temperature seems close but a bit higher than ambient as it will show a low temp of 35 degrees but the bird baths will have frozen solid. VERY disappointed spending 300+ for a station that performs so poorly. Sadly I was the manufacturer was adamant that the station would be accurate give it time so I didn't follow my gut and send it back. I will keep y'all informed if I am able to figure out a way to get this even close to accurate. Until they fix these issues I would avoid this station like the plague.	
I have this weather station in operation for 18 months more or less is a very cool but completely unreliable This last summer thunderstorm was the straw that broke the camels back. As I watched the accumulative rainfall - not the rate of rainfall - drift backwards from more that 2" to less than 1" until the rain stopped then rise again to 1.2" after it stopped. I just got so tired of its failed potential that I though I'd do something I hardly ever do and write a review. I was trained as a weather specialist in the Air Force and have always loved having my own weather equipment because it's fun to see the weather conditions right outside compared the area picture shown in weather apps like WeatherBug or AccuWeather. But this "weather station" is a joke! Over and over again, I have observed the accumulative rain show one amount and then a lesser accumulative rainfall later even thought it has been raining continuously. How does it "unrain"? Same thing with windspeed. I have seen the wind blowing so hard that rain and hail are traveling horizontally through the air, tree limbs will be crashing down and the wind speed, according to this Weather Station" will show as 5 mph with gusts to 10. That's an afternoon breeze not the wind blast from a Texas thunderstorm. I wish this worked, because the set up is easy, the equipment seems durable, it has a number of useful functions and if it was accurate it would be a lot of fun, but an unreliable weather station is about as handy as a broken watch.	1. Precise wind speed measurements-Explicit 2. Real-time weather conditions-Explicit 3. Enhanced reporting during extreme weather conditions-Explicit

Search #4

Keywords: Mini Weather Station

- Price: $300.00
- Vendor: Amazon
- Description: A micro outdoor weather sensor that collects accurate temperature, humidity, wind direction and speed, light and UV levels as well as rainfall data and transmit them to the HP2560 display console. The live data can be viewed on the console, WS View Plus or Eco Witt APP after Wi-Fi configuration.

Positive Comments

Voice of the Customer	Restated Customer Need
This unit replaces a ten+ year old Oregon Scientific station that over the last five years had steadily decayed. This HP2564 is far better in every respect. The package came with the WS90 all-in-one sensor ultrasonic anemometer/vane, piezoelectric rain gauge, light and UV sensor and thermo-hygrometer; the HP2560_C color display; a ring of bird deterrence spikes; and two paper manuals. The all-in-one sensor is compact and easy to set up. I installed two AA lithium backup batteries. I have it mounted on a PVC pole. I did not opt for the A/C heater module. I can't swear by the rain gauge, but it seems close to nearby station rainfall readings. The display is bright (brightness is adjustable) and easy to read. My unit is about 50 feet and two walls away from the sensor with all-bars on the WIFI icon lit up. It also comes with an interior thermometer and hygrometer, and micro-SD port, 32GB max FAT. The micro-SD card continually outputs readings in CSV format which are easy to analyze in Excel or similar spreadsheets and the card will take a long time to fill up. There is no battery backup (although the micro-SD card could be considered an approximation of same), so get a small UPS for the AC input if that's an issue. It's a little wonky to initialize, although the paper manual is adequate and online resources a little better. However, once you get used to the cumbersome sequential menu drill-down and value setting system (i.e., no touch screen nor direct go-to-setting shortcuts), it becomes quite usable. A cool	1. Bright and readable display-Explicit 2. Simple Setup-Explicit 3. Accurate results-Explicit

feature is that if the unit is in a bedroom, it can be scheduled to go dark and then re-enable at certain times (or can be manually darkened and re-enabled at any time). This might also be useful to prevent long-term screen burn-in, but the manual does not say that's a problem with this kind of display. Setup of WIFI and communication with the optional internet Ecowitt.net service is straightforward. I have not tried linking to Weather Underground. The Android app is easy to use, showing current readings. It also shows graphs of various measurements over different time intervals, including yearly	
Let's start with this: this is the best home weather station I've had to date. Excellent range on the sensors, clear bright display packed with information, easy mating with add-on sensors. I really like most of it. But Christmas on a crutch, the instructions are weak. They have a youtube as well but personally I would rather read. Still, with minimal diligence one can get it up and running.	1. Good sensor range-Explicit 2. Simple add-on features-Explicit 3. In depth manual-Latent
We had an older, off brand weather station and it was always giving us problems. So after a lot of reading/research, I decided to go with the Ecowitt Wittboy Pro. I really didn't want the display but my wife liked looking at the old display in the kitchen so I went in that direction. It was easy to set up The sensors are very accurate with the exception of the built in range gauge. It's fairly close but I added the WH40 rain gauge and it's spot on. I also added a lightning sensor and a water temp sensor for our pool. They also were very easy to set up. Put in the battery and the base display picked them right up. Another nice feature is I can link it with my WeatherUnderground account to see my weather from any browser. I also signed up for the Ecotwitt weather site, so I can see all of my weather data from a browser, along with their phone app.	**1. Establish website-Latent** **2. Simple setup**-Explicit **3. Battery powered**-Explicit

Negative Comments

Voice of the Customer	Restated Customer Need
1. Very disappointed with the display size of the HP2560c. There is too much information to display on such a small screen. It looked so much larger in the advertisement photos. If Ecowitt comes out with a larger one I will buy it. I can't read much of the display data unless I hold the display in my	1. Moderately sized display-Explicit 2. Appealing display-Explicit 3. Simplified user manual-Latent

hands. I know I have the information on my phone, but I like the display and like showing it off. 2. in my Manual the QR code is not correct for HP2560c Wifi set up. 3. The manual for the HP2560c must be used for more than the WS90 sensor and is confusing, because of different references to other sensors.	
The bad part. Setup is accomplished by scrolling through menus with up and down arrows like a 1984 Atari game console. Once you get and download the app you expect to breeze through with mouse and keyboard. Hah! The app offers an even better display than the base station but no additional functionality. This isn't the end of the world; once it is set up it is set up. But it is kind of cheesy. Finally, I have doubts about the haptic rain gauge. It has been bone dry since I bought it so I don't have empirical data to share. I'll compare it with an old fashioned accumulator and I'll let you know. The good news is that Ecowitt offers a tipping bucket rain gauge as an add-on. Other commenters have b*tched about its accuracy in heavy downpours but this is a homeowner system. If you want NIST accuracy you're shopping the wrong price point	1. Accurate measurements-Explicit 2. Incorporate modern aesthetics to display-Explicit 3. Moderate sized display-Explicit
I was looking forward to replacing my old Acurite 5 in 1 Weather Station with this new EcoWitt HP2564 providing all of the same features without moving parts and the need to replace batteries. The monitor and smartphone app met my expectations for measurement display but the weather station (WS90) left me in a quandary. The system came with two firmware versions out of date. I was able to update the firmware in the monitor (HP2560_C) but the WS90 was another story. First, the firmware updates can only be processed on a Windows 7 or higher machine. (Found out from Customer Support) I have an Apple Mac. After borrowing a Windows Computer from a friend I tried several times to load the new firmware to the WS90 without success. Customer Service is clearly from another country as the ReadMe file instructions and email responses for assistance are all in secondhand English and not very helpful. When you spend $300 for a weather station you are the type of person that plans to keep the firmware up to date and the WS90 is not User Friendly for firmware updates. The product is going back and I'll choose another weather station to replace my aging Acurite 5 in 1.	1. Compatibility with MAC-Latent 2. User-friendly firmware updates-Latent 3. Cross-platform monitoring-Latent

Search #5

Keywords: Small Weather Station

- Price: $106.17
- Vendor: Amazon
- Description: A High-precision 3-in-1 wireless weather sensor. Measures the temperature, humidity and wind speed and displays data to a screen. Easy setup and mounting with instructions

Positive Comments

Voice of the Customer	Restated Customer Need
This is my third AcuRite station I've bought over the past 10 years, only because of weather related issues with the outsid e units. My last one two weeks ago was struck by baseball sized hail that broke off one of my wind scoops. Luckily, even with the new outside unit, my other previous inside monitors still pick it up, so now I have three monitors of all sorts in my house. I do like the color monitor with this new unit. I'm not sure why people say they can't read theirs from different angles because I plugged mine in and can read it perfectly from all angles. It also looks good and is easier to read when the room is dark.	1. **Weather station durability-Latent** 2. **Color display preference-Latent** 3. **Variable display angle visibility-Latent**
Had a minimal sensor AcuRite and placed the outside sensor in the shade but weather is such a big thing in Tucson I added an upgrade and the sensor is in the sun with a wind speed. Set up was EASY and put both on channel C added batteries and it worked . Using to compare to the other the inside is very close and the in sun temps is up a few degrees. I LOVE the black background- the other lite up the roommate night but that's OK both are cool the combo is priced right, good quality and accurate so far-plus easy to set up	1. **Weather station placement flexibility**-Explicit 2. **Ease of setup**-Explicit 3. **Affordability**-Explicit
I had other weather stations that only showed the dew point until you reached certain temps, then it switched to heat index or wind chill, this one will show it all the time if you want. I love the extra features over some others I've had before like seeing not only the day high and low, but also the months high/low and all time high/low. I had a receiver for an older model Acurite 3 in 1, and it works off of the sensor as well, so anyone who is wondering if you can use more than one receiver for this, it's possible. Now I keep my older one	1. **Adjustable brightness for display**-Explicit 2. **Compatibility with older models**-Explicit 3. **Comprehensive historical data**-Explicit

upstairs in my bedroom and this main one in the kitchen. The screen is very bright with adjustable brightness, very easy to read.	

Negative Comments

Voice of the Customer	Restated Customer Need
Already broke	EXPLICIT -DURABLE
The display readability is poor, requiring a very specific viewing angle for things to appear bright The buttons on this are terrible, (loose, occasionally unresponsive, just cheap in general) Accuracy: Didn't experience any. With both units within 3 feet of each other, I received the following readings Temperature: Indoor = 188 F, Outdoor = 75 F (within 30 minutes, Indoor reading was 32 F) Humidity: Indoor = 88%, Outdoor = 41% (within 30 minutes indoor reading was blank) Time: Time and date were set, but within 20 minutes, the time was slow by 7 minutes I went through the calibration procedure, but it would not allow calibration of the indoor sensors, and routinely failed to advance from measure to measure with button presses. In general, the behavior seemed like there were firmware bugs or poor connections. I'd say quality control and construction materials should be reviewed.	1. Display readability-Explicit 2. Accuracy of readings-Explicit 3. Button quality and responsiveness -Explicit
Not very good. Wind speed sensor reads low. The weather forecasting feature is wrong more often than not. The display is too bright and the history is annoying as it continually flips from one sensor to another. If I could return this I would but have had for over a month so can't.	1. Accurate wind speed sensor-Explicit 2. Return policy-Latent

Jamboard

Once the needs were thoroughly understood and weighted, the team proceeded to convert them into precise specifications. This involved translating user needs into functional requirements. For example, if users emphasized the need for accurate temperature readings, a specification was developed: "Temperature sensor with an accuracy of ±1°C." Design considerations were also incorporated into these specifications, addressing how each need

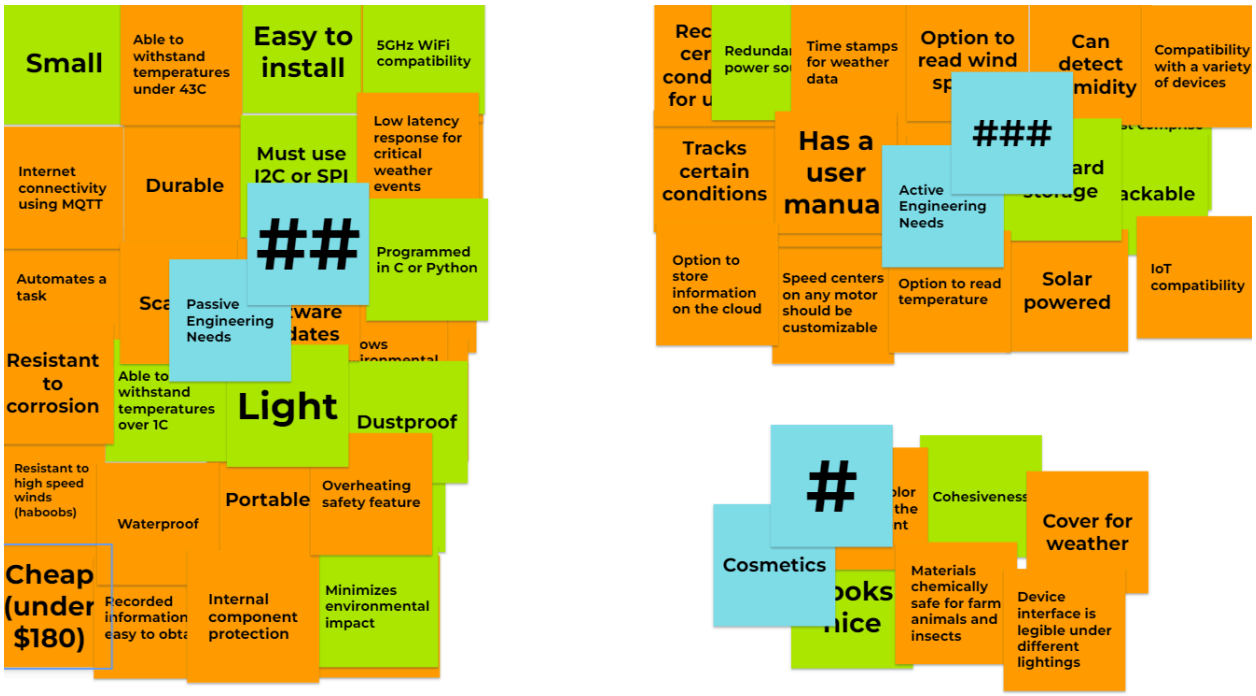
would be met. For instance, if durability was a crucial requirement, specifications included details about materials and construction methods ensuring the product's longevity.

To assign appropriate weights to each need, our team employed an approach that prioritizes needs which surfaced more frequently in user interviews and were assigned higher weights. For instance, if product reliability was a common concern mentioned by 80% of users, it received a correspondingly higher weight. Additionally, qualitative data was considered to fine-tune these weights. If a particular need was strongly emphasized by users, it was granted a higher weight, even if it wasn't the most frequently mentioned.

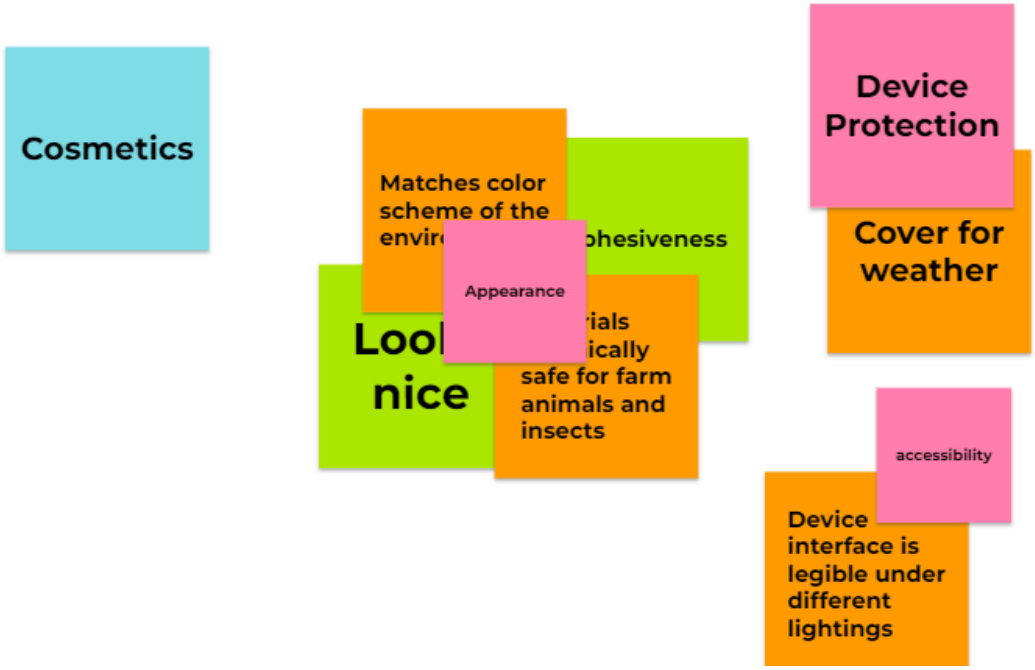
Unorganized Jamboard

Grouped Jamboard

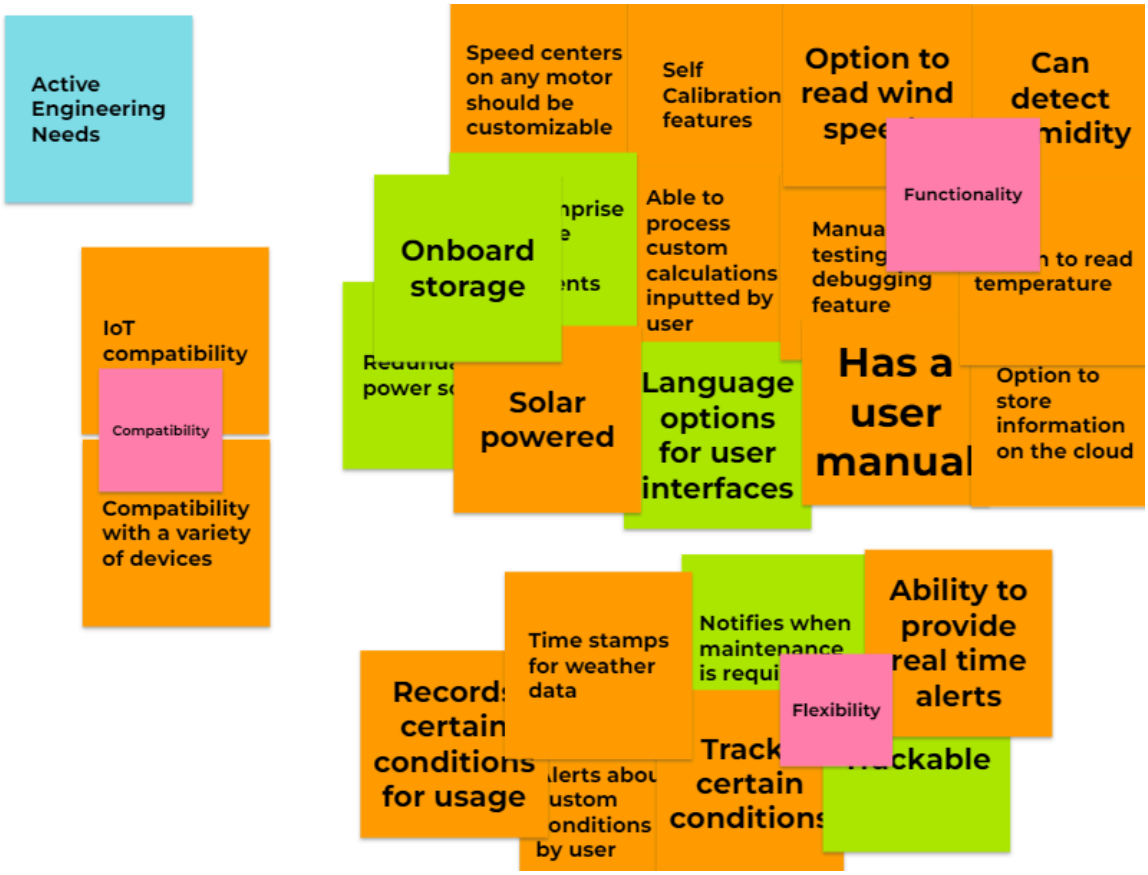
Ranked Groups



Cosmetic Meta Needs



Active Engineering Needs



Passive Engineering Needs

Passive Engineering Needs

- EXPLICIT - Small
- EXPLICIT - Cheap (under $180)
- EXPLICIT - Easy to use
- EXPLICIT - Easy to install
- EXPLICIT - Easy to maintain
- EXPLICIT - Portable
- EXPLICIT - Able to withstand high temperatures (43C)
- EXPLICIT - Able to withstand low temperatures (1C)
- EXPLICIT - Durable
- EXPLICIT - Self sufficient
- EXPLICIT - Easily replaceable parts
- EXPLICIT - Easy to integrate with existing systems
- EXPLICIT - Robust and durable housing to protect internal components
- EXPLICIT - Resistant to corrosion
- EXPLICIT - Resistant to high winds speeds (haboobs)
- EXPLICIT - Low power consumption
- EXPLICIT - Records are easy to obtain
- EXPLICIT - Follows environmental regulations
- EXPLICIT - Waterproof
- EXPLICIT - Scalable
- EXPLICIT - Dust prevention

- EXPLICIT - Capacity for software updates
- EXPLICIT - Low latency response for critical weather events
- EXPLICIT - Code Written in Python or C
- LATENT - Lightweight
- EXPLICIT - Compatible with 5Ghz Wi-Fi connection
- EXPLICIT - Internet connectivity using MQTT
- EXPLICIT - Automates a task
- EXPLICIT - Must use I2C or SPI for communication between sensors and actuators
- EXPLICIT - The system should be designed to minimize environmental impact

Active Engineering Needs

- EXPLICIT - Notifies when maintenance is required
- EXPLICIT - Alerts about certain conditions set by the user
- EXPLICIT - Track certain conditions
- EXPLICIT - Record certain conditions for usage
- EXPLICIT - Any speed settings should be able to be modified
- EXPLICIT - Self Calibration features
- EXPLICIT - Able to process certain calculations inputted by user
- EXPLICIT - Language options if there is an interface
- EXPLICIT - Must use surface mount components
- EXPLICIT - Backup power source
- EXPLICIT - Time stamps for weather data
- EXPLICIT - Manual testing and debugging features
- EXPLICIT - User manual
- EXPLICIT - Users need the option to export data to cloud storage services
- EXPLICIT - The mobile weather station should have a built-in GPS for location tracking
- EXPLICIT - The system should provide real time alerts for varying weather conditions
- EXPLICIT - The system should integrate solar power options for energy sustainability
- EXPLICIT - The motor controller should have a safety feature to prevent overheating
- EXPLICIT - Backup data storage option in case of internet outage
- EXPLICIT - Option to read humidity
- EXPLICIT - Option to read wind speeds
- EXPLICIT - Support integration with smart home systems
- EXPLICIT - Option to read temperature

- LATENT - Compatible with a variety of devices

Cosmetics

- LATENT - Color scheme matches environment
- LATENT - Materials and colors chemically safe for animals
- LATENT - Clear and legible screen under different lightings
- LATENT - Aesthetically pleasing to look at
- EXPLICIT - Cohesiveness
- EXPLICIT - Weather resistant cover

Design Ideation

Our team approached the start of the design ideation process by individually brainstorming ideas. There was no limit or personal requirements. We just needed to create as many ideas as possible. We came up with roughly 20 ideas but we began to run into obstacles as we continued to do more and eventually plateaued around 25. We then decided we needed to do something more systematic. Our team then created the Morphological Chart [figure]

By listing all the possible requirements, industry applications and aesthetic elements in separate columns we were able to pick paths that consisted of one element per column without duplicates. And at the end of the table we had a possible idea for a product. This ballooned our possible options from 25 to 6720. It became a lot easier after creating different products. With more to work with, we used a simple tier list to rank ideas according to our defined user needs and requirements, with S being a serious choice for the main project, going down to C which were projects that could be good but difficult to fit with our current time schedule [figure]. After ranking, we chose our S tier options and utilized AI generated images to get an initial concept.[figure, figure, figure]