

Product Requirements Document

Project B298

EGR 314

Team 208

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Introduction

A portable fan controlled by sensors represents a modern and efficient approach to personal cooling solutions. By integrating sensors that monitor temperature, wind speed, or humidity, this innovative fan offers a dynamic and responsive cooling experience tailored to individual preferences. This introduction sets the stage for exploring the objectives, stakeholders, use cases, aspects, open questions, milestones, and an explanation of terms associated with this technology.

Objectives

- **Enhance User Comfort:** The primary objective is to provide users with a comfortable and personalized cooling experience by dynamically adjusting fan settings based on environmental conditions.
- **Energy Efficiency:** Optimize energy consumption by intelligently adapting fan speed and operation to meet cooling needs without unnecessary power usage.
- **Portability and Convenience:** Design the fan to be portable and easy to carry, allowing users to enjoy personalized cooling in various environments.
- **Seamless Integration:** Ensure compatibility with smart home systems and other technologies for a seamless and interconnected user experience.

Stakeholders

Consumers: Individuals seeking efficient and personalized cooling solutions.

Manufacturers: Companies involved in designing, producing, and marketing portable fans with sensor-based control.

Technology Providers: Entities supplying the sensors and smart technology integrated into the fan.

Regulatory Bodies: Organizations overseeing standards and regulations related to fan safety and performance.

Use Cases

User Story #1: David

David is a 30 year old who has an office job. The only issue with his office job is during the summer there are some days that the a/c is not working as well as it should, meaning it is very hot inside the office. Although he would normally try and go home early on a day like this he has a ton of work he needs to get completed. Our product is able to detect the temperature in the office and cool him off despite it being so hot. The temperature reading fan allows David to not only feel comfortable inside his warm office but he is not distracted by the noise that comes from the fan.

It is very easy for David to use the fan because not only does it keep him comfortable but he is able to move it in any angle or direction he needs. Because he is able to take it with him anywhere he goes he has more uses than just the office!

User Story #2: Jonathan

Jonathan is a 27 year old man who took his family to an amusement park. Although the family is having a lot of fun he notices that everyone is tired, not only from walking all day but from being in the sun. To help his family cool down he decides to purchase some water, but it is not enough! He remembers he has his fan and is able to use it to cool down his family. Because the fan is able to detect temperature, it will go at a pretty quick rate, that will be adjustable so it is able to cool down all of his family. After it turns dark the fan can also nearly seem like a toy, because of the lights that are all over the fan he is able to use it as a distraction for his children, while also keeping them cool!

User Story #3: Sarah

35-year-old Sarah is a small poultry farmer from Texas. She keeps chickens, guinea fowl and turkeys. During the winter and summer seasons, Sarah's farm requires constant temperature control for her birds. Recently, Sarah has been researching the use of a mobile weather station to aid in this endeavor. A mobile weather station detects rainfall, temperature, humidity, wind speed and wind chill along with other relevant data and transmits the data to a server. This data can then be accessed by Sarah's smartphone or computer to determine the weather surrounding his farm, which can then be used to properly keep his birds healthy and warm.

Aspects

1. Product Design

The new product design will be based on that of existing digital fans with improvements based on the following requirements:

- 1.1 The product shall be made of weather resistant material. (P9)
- 1.2 The product shall include hardware that is easy to access.(P8)
- 1.3 The product shall be easily cleansed.(P9)
- 1.4 The blades included in the product shall be safe but also effective. (P9)
- 1.5 The product shall be customizable in some way so the user feels like it is their own. (P8)
- 1.6 The product's shape will facilitate better air flow. (P5)
- 1.7 The product shall have a maximum size of 100 x 100 mm. (P10)
- 1.8 The product shall have a maximum of 3.3V. (P10)

2 Functionality

- 2.1 The rate of the fan shall spin at a comfortable speed. (P7)
- 2.2 The product shall be able to determine temperature so the rate of the fan is spinning at a rate that would be useful for the user. (P9)
- 2.3 The product shall be able to determine wind speed. (P8)
- 2.4 The product shall indicate temperature in some way.(P8)

3 Interactivity

- 3.1 The user shall feel comfortable setting up the product. (P8)
- 3.2 The user shall not have any issues understanding the product. (P8)
- 3.3 The product shall be easy to carry around. (P7)
- 3.4 The product shall not be too noisy for the user. (P8)
- 3.5 The user interface shall be intuitive for all users after a single moment of learning how it works. (P9)
- 3.6 The product shall not be heavy. (P8)
- 3.7 It shall be easy for the user to start up the product. (P7)
- 3.8 The product shall be designed so as to prevent accidental use. (P8)

4 Customization

- 4.1 The product shall be able to use lights that can indicate wind speed. (P7)
- 4.2 The product shall be able to switch the color of the lights at the user's discretion. (P6)
- 4.3 There shall be LEDs on the blades that will indicate the speed of the fan. (P5)
- 4.4 The color of the blades shall be able to be changed based on the user. (P6)
- 4.5 The user shall be able to control the speed of the fan. (P7)

5 Manufacturing

- 5.1 The total FOB cost price of the product shall be <\$240. (P9)
- 5.2 The product shall be made out of a durable material. (P9)
- 5.3 The product shall be designed to assemble in under 60 seconds. (P7)
- 5.4 The position of any component cannot change during assembly. (P10)
- 5.5 The blades shall be made out of a material that allows for the most efficient spin rate. (P8)
- 5.6 The build of the product shall be determined based on safety and efficiency.(P10)
- 5.7 The materials shall be cheap so it is easily produced. (P6)
- 5.8 The battery life for the materials shall be durable. (P7)
- 5.9 The product shall be able to withstand a diverse range of environments. (P8)

6 Regulations/Safety

- 6.1 The product shall not have any exposing wires. (P10)
- 6.2 The product shall not overheat to the point it is dangerous. (P10)
- 6.3 The product shall not have sharp blades. (P10)
- 6.4 If the product uses batteries, they shall be out of reach. (P10)
- 6.5 The product shall not have small pieces. (P10)

6.6 The product shall not be too bright. (P10)

6.7 The product shall not have a voltage higher than 3.3V. (P10)

Open Questions

- Can we improve the safety of our product? Yes we can. During our final testing our motor drew current which shorted our board. We believe to make the product safer, the inclusion of a fuse and also more low voltage solutions would be required.
- Can we make the product more user-friendly? The current scope of our product was to monitor the data from the sensors. To make it more user friendly, we would make an app that allows the user to manipulate the device based off the results.
- Can we improve data accuracy and transmission? To improve data accuracy, we would require better circuit design, higher quality parts and proper software integration. The software calculations can be tailored to be accurate by adjusting the voltage to bit ratio (using an appropriate v_{ref} and v_{dd} to match our adc)
- Can we integrate the data into smart home systems? The data can be integrated into a smart home system using a more advanced code than what we used to publish to the MQTT server.
- What changes can be made to make the product more customizable? For customizability, we could improve the outer appearance/home for the circuitry. We can also add calculations to give the results in other units (like C and K for temperature, or kmph for wind speed)
- What changes can we make to the product to achieve better user satisfaction? To achieve better user satisfaction, we can change the fan shape to cover a wider area and we can work with better quality parts and build a better board for more reliability.

Milestones

Concept presentation: January 19, 2024

Design presentation:

Design freeze:

Innovation Showcase: April 26, 2024

Explanation of Terms