EE476C – Project Design Procedures	
Problem Statement	
https://sites.google.com/nau.edu/smartfan/home	
Group: SmartFan	
Term/Year: Fall 2022	*Date*: 12/16/2022

1. Statement of Needs

The Smart Fan must consume a low amount of power. The temperature sensors must be durable, weather resistant, and in a shaded area. The software and board used must be low power consumption. The client requests that we code in Python. Using available data from websites like Accuweather, we can forecast the weather. The fan can work with a Nest or an equivalent smart thermostat to set the temperature. The fan must be cost-effective, so it can be implemented in countries needing AC.

2. Statement of Objectives

This work aims to design and build a prototype for a device that will leverage the temperature differential between ambient air and household air to reduce the need for energy-intensive temperature regulation. The Smart Fan will be composed of fans, temperature sensors, and a control panel that communicates with the latter.

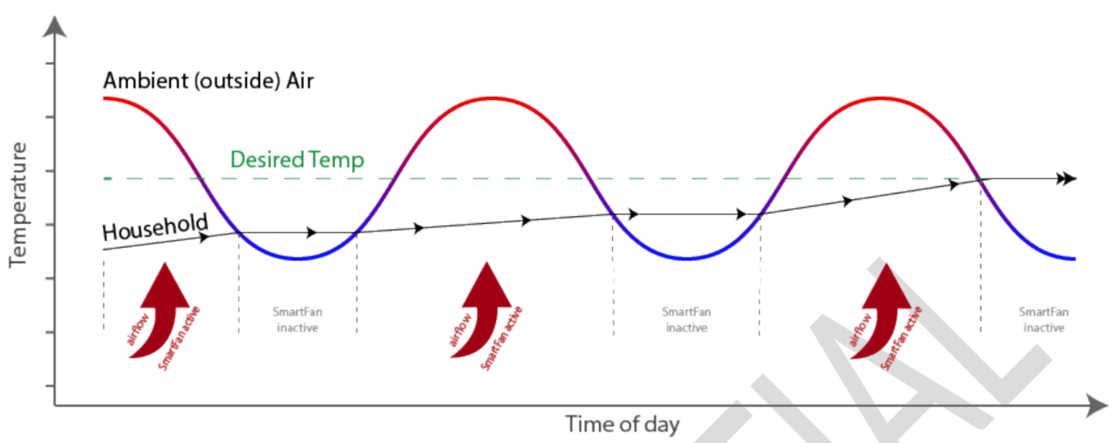


Figure 1: Diagram of hypothetical operation of SmartFan heating a home through a time when the outside air temperature fluctuates, given an assumed desired temperature and initial household temperature.

3. Literature Research

The core principle of fans is to create airflow, evaporative cooling, and destratification. Fans increase airflow by circulating air across the room. An electric fan converts electrical energy into mechanical energy using magnetic fields. Four-blade fans are supplemented as an air conditioner as it circulates cooler air. It is a misconception that the more blades a fan has, the cooler air is circulated. That is not the case. Five-blade fans are designed for aesthetic purposes and have no effect. Although forward curved blades are quieter, backward curved blades are more energy efficient. A forward-curved blade fan works best with more fans, whereas backward-curved fans use a smaller amount.

Other teams are working on expanding the functionality of fans by balancing humidity, lowering ceiling temperatures, improving thermal comfort, and many other things. Some limitations of current technology require an electric outlet, limitation of circulation in small spaces, lack of stability, and fast burnout. Our design will solve the electric plug-in issue by possibly adding a solar component. We also will implement a two-fan operation to demonstrate efficiency in large areas. We are designing a window unit fan to avoid material damage and user injuries to address the lack of stability.

4. Requirements

The client wants the fan to be cost-effective to increase access in areas that do not have AC, which includes the cost to purchase, build, and repair. The fan must also have a lifespan of 12 months. The temperature sensors must be mounted in a shaded area to prevent damage or false data collection. The project's hardware must fight climate change in creative and engaging ways. The hardware and software aspects must follow low-power wireless communication protocols.

5. Objective Tree

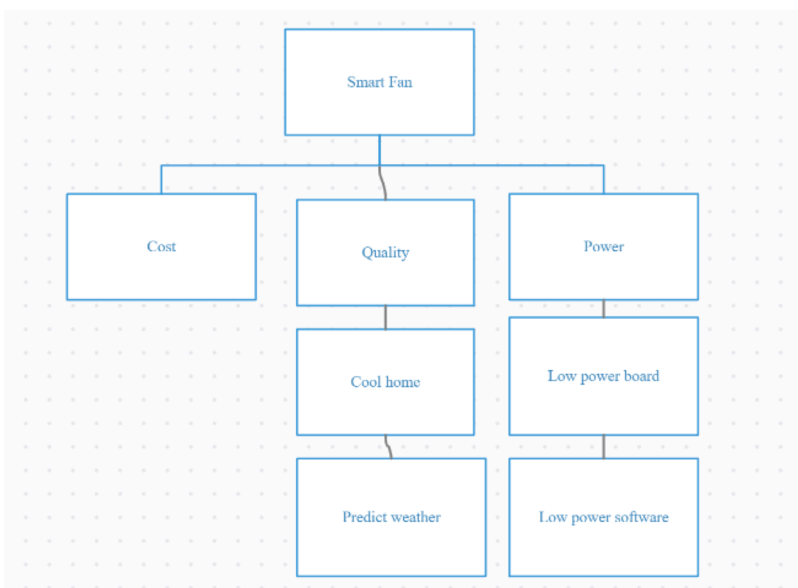


Figure 2: Objective Tree

	Cost	Quality	Power	Weight
Cost	1	1/3	1/5	0.2
Quality	3	1	1/4	0.3
Power	5	4	1	0.5

Figure 3: Pairwise Comparison

6. Functional/Behavioral Analyses for System

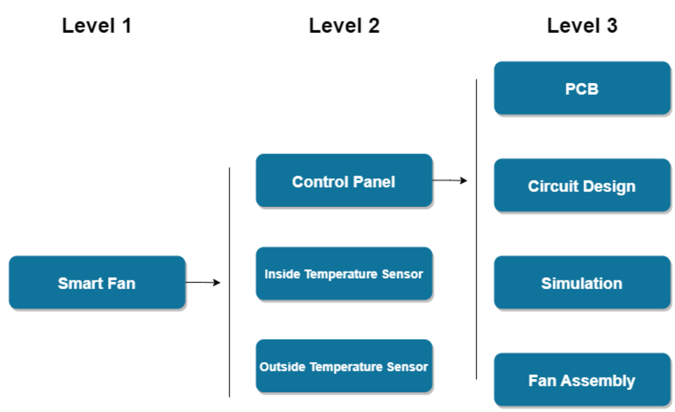
The defining characteristic of our project is the code for our smart fan. Based on four different inputs, a desired temperature set by the user, one thermistor outside, one thermistor inside, and a weather forecast, the fan itself will then run in order to reach the desired indoor temperature set by the user. As the system becomes more developed the code will eventually be able to superheat/supercool a building to reduce energy consumption by running the fan at once.

7. Testing Matrix for Prototype

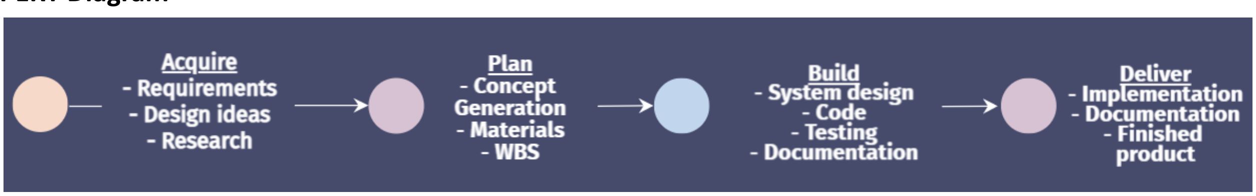
We decided on a thermistor-LED system for our prototype. The thermistors will measure the temperature when the system is running and provide a log of the current temperature information. The LED light will turn on to indicate fan activation if the temperature is either over or below the stated temperature in the code. After some time, the system crashed, although we think it was due to the thermistor age. We set the temperature to 65 degrees Fahrenheit to test the system, and when the thermistor temperature was above the set temperature at 70 degrees Fahrenheit, the LED turned on.

8. WBS/PERT Diagram/Gantt Chart for System

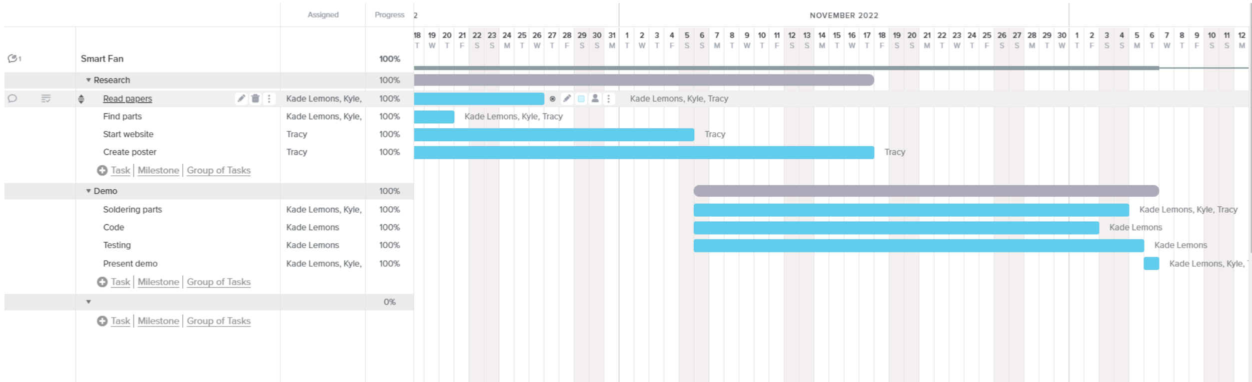
Work Breakdown Structure (WBS)



PERT Diagram



Gantt Chart


Assigned
Progress
NOVEMBER 2022
Smart Fan
100%
Research
100%
Read papers
Kade Lemons, Kyle,
100%
Find parts
Kade Lemons, Kyle,
100%
Start website
Tracy
100%
Create poster
Tracy
100%
Task | Milestone | Group of Tasks
Demo
100%
Soldering parts
Kade Lemons, Kyle,
100%
Code
Kade Lemons
100%
Testing
Kade Lemons
100%
Present demo
Kade Lemons, Kyle,
100%
Task | Milestone | Group of Tasks
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Kade Lemons, Kyle, Tracy
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