

## Appendix

### Design Brief Template:

**School:** Cottonwood High School

**State:** Utah

**Division:** Middle School or **High School**

**Team Members' Names:** Nour Alsabsabe, Siona Cook, Diana Trifanenkova, Jessica Fonseca

**Project Title:** Readers should have a glimpse at what the project is about and want to read more. (25 word maximum)

You may very well be at risk of indoor air pollution. With BreatheEasy, our device automatically opens your window upon detecting poor indoor air quality.

**Project Purpose:** In one or two sentences simply identify the inequity being addressed and explain what this project intends to do. (50 word maximum)

The inequality being addressed is indoor air pollution, which particularly affects low-income households, children, and elderly. Our project intends to improve indoor air quality by using our device to automatically open windows once detecting harmful indoor air pollutants and automatically opening windows, thus promoting one's health in an accessible way.

**Abstract:** Briefly introduce the people who will benefit from the project and the challenges they face. Discuss the inequity they face and explain how the proposed solution addresses it. (100 Words Maximum)

Our product is considerably helpful for children, elderly, and people in low-income households. The product can automatically open your window once it detects harmful air levels, promoting air quality in low-income households who tend to live near industrial facilities or high-traffic roads. It also benefits elderly and children who are vulnerable to health problems, such as cardiovascular or respiratory diseases. These diseases become worse when exposed to polluted air, so by making the product accessible, we can help ensure that all communities have access to technology that improves indoor air pollution regardless of their age or income.

**User Research:** Discuss key information about the users gathered through your research, interviews, and discussion with the user throughout the project. What did you learn about the user and the barriers they face? (200 word maximum)

Many contributors to poor air quality can take place in your own home. Actions such as using cleaning sprays or cooking with a gas stove release harmful chemicals and gasses that you might be unaware of. Add that to a lack of air ventilation, and your indoor air quality is likely to be at unhealthy levels. According to the National Institutes of Health, "in developed countries, around 80% of time is spent indoors." This prolonged time indoors poses a great risk to people breathing in harmful air, which elderly and children are more susceptible to. A study done by MESA Air found that elderly spend 72% of their time indoors per week. When discussing it with an elderly couple, they told us that they find it "difficult moving around the house." Not only that, but many elderly and children suffer from respiratory issues, which can be exacerbated if they're constantly breathing in polluted air. In addition, low-income households suffer from

excess air pollution partly because their homes tend to be located near factories or major roads, but also because of smoke or cooking fuels.

**User Insight:** Discuss your team’s understanding of the experiences, emotions, and motivations of the users, i.e., share the struggles, fears, and frustrations the inequity causes the user. What did you learn about how the barriers affect the user? (200 word maximum)

Families may feel a sense of relief that they are able to purchase inexpensive cleaning products that allow them to maintain a sanitary living environment; however, they may also feel frustrated, fearful, and overwhelmed by the potential health risks associated with using these chemicals. The use of harmful cleaning products may also aggravate existing health concerns for these families, especially in areas with high levels of pollution. When it comes to children, they are more vulnerable to air pollution because their bodies are still developing. This worries parents about the long-term impact on their health and that of their children, which can cause feelings of anxiety and uncertainty. Additionally, the cost of medical treatment and health care can be prohibitive for low-income families, which can further their stress and financial burden. These families may not be aware of the risks associated with the chemicals in these cleaning products or have access to alternatives that are safer and more environmentally friendly. This lack of knowledge and access to resources can create barriers to making informed decisions about the products they use, further perpetuating the cycle of inequity.

**User Needs:** Develop a specific list of the user’s needs produced from the insight. Include specific functions or features required by the user. What does the user want to help them with the barrier? (100 word maximum)

**Our users would find the following helpful:**

- Reliable detection of hazardous gasses
  - This can assist them in taking actions to decrease exposure and enhance indoor air quality.
- Automatic window opening to ventilate the area
  - Assists people who are unable to open window quickly (i.e. children, elderly, and blind or deaf people)
  - A simple and effective technique to promote ventilation in the room or area where the sensor is installed.
- Affordable
  - The device is accessible to low income families
- Easy to utilize and comprehend
  - The device is easy to use and assemble

**Project Goals:** List specific goals you want your project to address. Describe how they will meet the user’s needs and address inequities faced by the user. Meeting these goals should be reflected in the key features and graphic(s) provided. What do you want the project to do to help the user? (100 word maximum)

- Improve the user’s indoor air quality by detecting indoor air pollution and automatically opening windows to promote the circulation of fresh outdoor air
- Increase accessibility for the user by designing it to be more affordable by incorporating features such as low-

cost sensors

- Enhance safety by detecting hazardous gases accurately and promptly
- Ensure continuous protection with battery backup and failsafe mechanisms
- Facilitate easy installation and maintenance for users with varying abilities

**Key Features of Design:** List key features, illustrating that the design will adequately meet project goals. How will the project help the user? (200 word maximum)

1. **Accurate gas detection:** Sensors will detect hazardous gasses, such as carbon monoxide, methane, radon, carbon dioxide, and volatile organic compounds (VOC).
2. **Automatic window opening:** Once detecting harmful gas levels, the device will automatically open windows, allowing for ventilation and reducing gas concentrations.
3. **Failsafe mechanisms and manual override:** The device will include options for manual window opening or closing in case there's a malfunction or power loss, thus ensuring safety even in emergencies.
4. **Battery:** A built-in battery will keep the device functional in case of power outages
5. **Easy installation and maintenance:** The device will be designed for easy installation and low-maintenance operation in order to make it accessible to users with varying levels of physical ability

**Impact:** Discuss how the design helps the user overcome the inequity. Include impact statements from the user. Does the project help the user? How? (200 word maximum)

BreatheEasy is a product that assists individuals in reducing indoor air pollution. The device detects contaminated air and automatically opens the window to allow fresh air inside in order to improve the indoor air quality. BreatheEasy has a significant influence on a person's health and well-being since it helps limit exposure to hazardous contaminants that can cause respiratory disorders and other health concerns. BreatheEasy is intended to be simple and convenient for users. When interviewing potential users, they agree that our device seems simple to set up. To show them the device in action, we lit a contained fire in order to produce smoke. Once polluted air is detected, the device has a light that appears red, alerting the user that there are air toxins, so it will open the window. They were fascinated to see the device in action as it automatically opened up their windows to allow fresh air to circulate. They stated that "your product would be a big help to us." Even though in this example it detected smoke, the sensor can also detect carbon monoxide, coal gas, and liquid gas.

**Status of Project:** Describe the current status of the project, including feedback on design from the user, and discuss potential next steps. What does the project do now? What would you like to work on in the future? (200 word maximum)

Currently, our product only works on slider and hinged windows. BreatheEasy automatically opens your window upon detecting harmful chemicals such as carbon monoxide, methane, or LPG. Once the sensor doesn't detect any harmful levels of air pollutants, it will close the window. In the future, we are planning to improve our device's usability and effectiveness by creating variations that work on different types of window in order to open any window. Also, we will simplify our design in order to make our product cheaper, neater, and more appealing. We also want to create a user-friendly app, which enables the users to comprehend the data they receive from our device. This data is based on the amount of when harmful gasses have been detected in your house. We also want to include common languages used by our users, to help those who are not fluent in English. Feedback from a user was the pollution outside making the pollution inside worse, so they recommended a sensor on the outside of the window as well. We agree that this is important because if the window is open when outdoor air is worse than indoor air, the results would be opposite than what's desired.

**Reflection:** Show that your team has an increased understanding of human-centered design. Examples of personal growth and insights gained about designing for others and helping them overcome challenges should also be included. What did you learn about designing for others? (200 word maximum)

Our design seeks to understand needs and problems that indoor air pollution creates. Air pollution is a significant global issue that affects people around the world. The sources of indoor air pollution are varied, but some include cleaning supplies, furnishing, furnaces, and gas stoves. Air pollution affects people of all ages, but children, elderly, and people with pre-existing health conditions are especially vulnerable to the negative effects of indoor air pollution. On a daily basis, people may experience trouble breathing, chest pain, headaches, and other respiratory symptoms. It can also have an impact on work productivity, school work, and overall quality of life. During the manufacture of our product, there were a lot of problems along the way, such as problems in the code and problems with the motors, but because of our desire to help those who can be helped by our project, our team had the strength to overcome and fix all the problems that came along the way. We address the issue of indoor air pollution to you, and present our device, BreatheEasy, that can help ventilate polluted air out of your house.

**Prototype Graphic:** A single graphic with key features adequately labeled. It should be easy to understand and the reader should have a general understanding of how the prototype functions by looking at the graphic.

Prototype Graphic:

