

# Airing

## AIRING CASE STUDY

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# INTRODUCTION

# INTRODUCTION

## PROBLEM

Because of the wild fire in Napa, the air quality in San Francisco was very bad. Some insensitive people may not notice that, but it hurts our bodies.

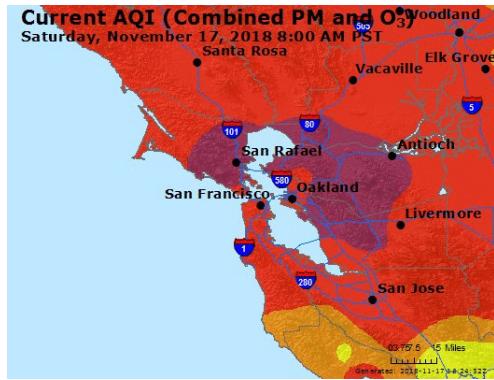
# INTRODUCTION

## SOLUTIONS

Airing IOT design is a intelligent window that can check the air quality and switch the window automatically. Windows open automatically when the air is good enough to ventilate the room, and when the air quality is very bad, the Windows will be closed.

**RESEARCH**

# RESEARCH



The Bay Area's already fetid, wild-fire-choked air continued to register "very unhealthy" levels of particulate matter throughout the region Friday morning, following public health warnings and mass closures of

schools, universities, businesses — even San Francisco's fabled cable cars were pulled off the hills.

Just like smokestacks and tailpipes, wildfires fill the air with the byproducts of combustion, including very dangerous small particles known as PM2.5, which can get into the lungs and bloodstream. A growing body of research has demonstrated that these particles degrade health and contribute to thousands of deaths each year in the United States alone by causing respiratory, cardiovascular and other health problems.

## RESEARCH

Pierce presented the highest numbers at the meeting. He estimates that between 5,000 and 25,000 people in the United States may die each year at present from PM2.5 that specifically comes from the smoke of wildfires burning in the United States and other nearby countries (such as Canada). But the number of wildfire-linked deaths could triple by the end of the century for high levels of global warming, he has found, based on one climate modeling scenario (which, Pierce emphasizes, is only a preliminary finding and should be replicated by other scientific groups).

# RESEARCH

Some people may say, if the air quality is so bad, why don't we keep the Windows closed all the time?

**Because ventilation is also very important**

Ventilation is critical to home comfort. Proper ventilation prevents air pollutants from affecting the health of you and your family. Not only that, having airflow in your home can get rid of any unwanted smells, such as from cooking or pets. It is also good to have an airflow that is uninterrupted, as anything blocking the air flow in your home can cause damage to both your home and your health.

## RESEARCH



One of the reasons ventilation is so important is because it controls how much moisture is lingering in your home. If you have adequate airflow throughout your home, your walls, floors, and all the wood in your home will stay dry and not collect moisture. Wood can rot when exposed to moisture, as can drywall. If you let moisture build up in these areas of your home, they will not only destroy the structural integrity, but they will also cause mold to build up. Mold can have a number of negative effects on your health if you are exposed to it for a long time.

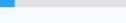
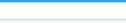
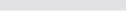
# RESEARCH

## SURVEY RESULTS

1. What is your gender?

Option 	Subtotal 	proportion
male	218	 52.66%
Female	196	 47.34%
<b>This question is valid for the number of times</b>	<b>414</b>	

2. What is your age?

Option 	Subtotal 	proportion
Under 18 years old	51	 12.32%
18-35 years old	354	 85.51%
35-60 years old	4	 0.97%
60 years old or older	5	 1.21%
<b>This question is valid for the number of times</b>	<b>414</b>	

# RESEARCH

## SURVEY RESULTS

### 3. Do you know PM2.5?

Option ↴	Subtotal ↴	proportion
To understanding	106	 25.6%
Know a little	223	 53.86%
Don't understand	85	 20.53%
<b>This question is valid for the number of times</b>	<b>414</b>	

### 4. Do you think PM2.5 is harmful to people's health?

Option ↴	Subtotal ↴	proportion
Have	379	 91.55%
No	5	 1.21%
do not know	30	 7.25%
<b>This question is valid for the number of times</b>	<b>414</b>	

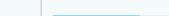
# RESEARCH

## SURVEY RESULTS

5. Do you know the best time for indoor ventilation?

Option 	Subtotal 	proportion
To understanding	44	 10.63%
Know a little	154	 37.2%
not very clear	216	 52.17%
<b>This question is valid for the number of times</b>	<b>414</b>	

6. Do you know the cause of PM2.5 exceeding the standard?

Option 	Subtotal 	proportion
To understanding	76	 18.36%
Know a little	171	 41.3%
not very clear	167	 40.34%
<b>This question is valid for the number of times</b>	<b>414</b>	

# TARGET MARKET

## TARGET MARKET

## FEATURES & CONTENTS

Features:

1. Measure outdoor PM2.5 and control the opening and closing of Windows automatically.
2. User will receive a notification when the PM2.5 is over 35~75 $\mu\text{g}/\text{m}^3$ .
3. Set a timer to close the window.

Goals:

Helps people prevent the PM2.5 from harming the health.

# TARGET MARKET

## USER PERSONA



### **ALICE MOORE**

College Student

20

San Francisco, CA

Alice is a student from AAU. She has a light pneumonia, and her doctor advised her to pay attention to the air quality around her. Because of the fire in Napa a few days ago, the air quality in San Francisco was affected. Alice felt very uncomfortable, so she has to close the window.

# TARGET MARKET

## USER PERSONA



### KYLE HART

Web Designer

25

San Francisco, CA

KYLE had pneumothorax a few years ago, so he was very concerned about air quality. He checks the air quality index, pm2.5, every day when he goes out.

# **DESIGN PROCESS**

# USE CASES & USE CASE SCENARIOS

Use Case 1: User wants to open the window.

Use Case Scenarios:

- Press the button..

Use Case 2: User wants to switch to automatic mode.

Use Case Scenarios:

- Double press the button .
- Window will close automatically when the PM2.5 is over 200  $\mu\text{g}/\text{m}^3$
- and receive a message when the PM2.5 is over 300  $\mu\text{g}/\text{m}^3$ .

Use Case 3: User wants to set a timer to close window.

Use Case Scenarios:

- Press the timer button under manual mode.

# CORE TECHNOLOGY

## a. Arduino

- Input Sensor: Dust Sensor
- Outputs: Servo Motor

## b. Server

- Compute
- Intelligence, server would analyze the data and control the motor

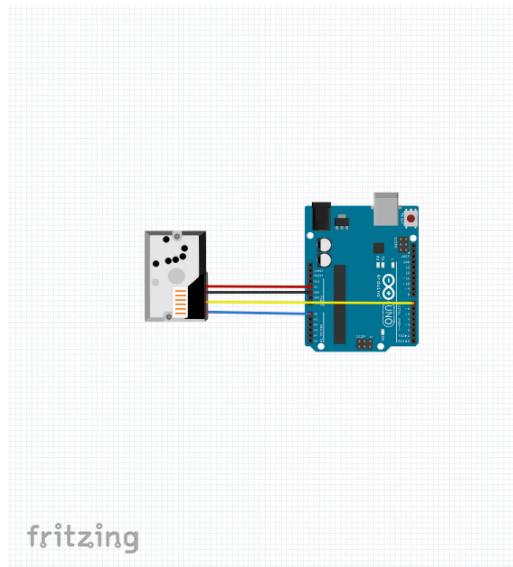
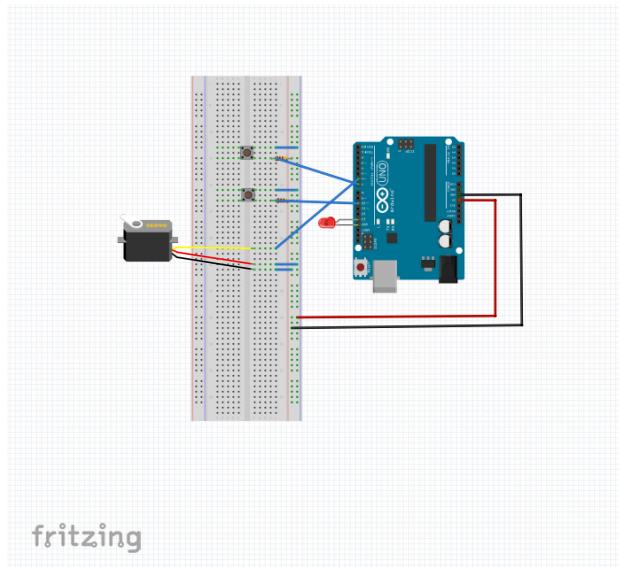
## c. Database

- Air quality data at Real-time
- Analysis

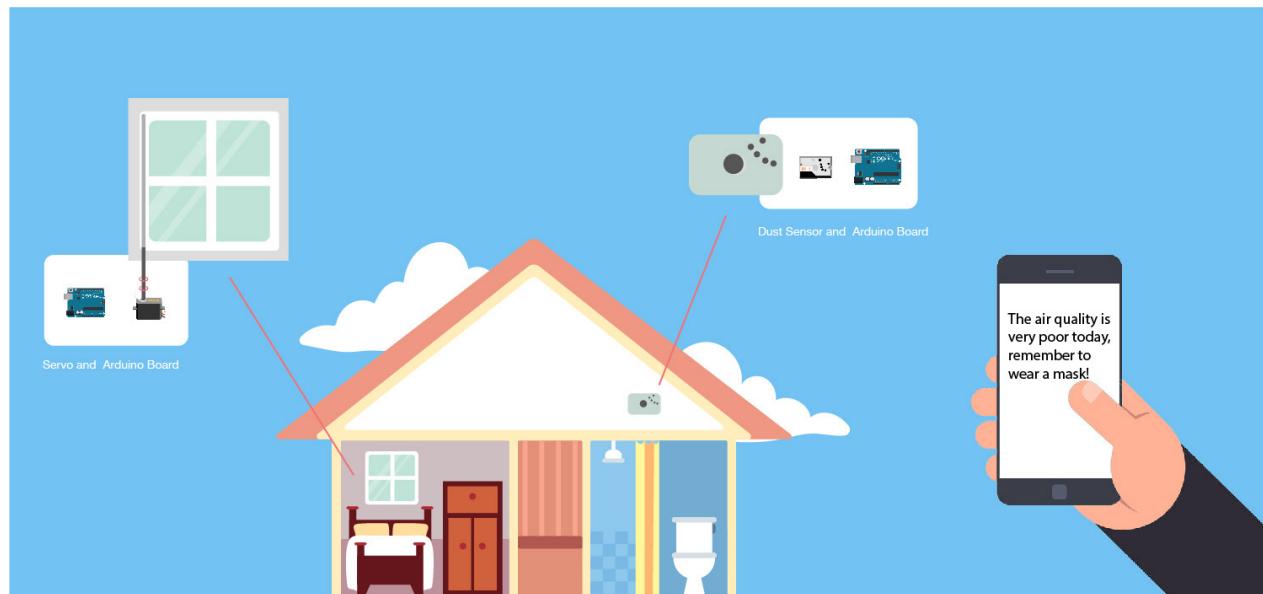
## d. Mobilephone

- Notification (when the air quality is bad)
- Outputs: Real-Time data

# FRITZING



# VISUAL SKETCH OF IDEAL



## CODE

```

#define COV_RATIO 0.2    //ug/mm / mV
#define NO_DUST_VOLTAGE 400 //mV
#define SYS_VOLTAGE 5000 //mV

/*
I/O define
*/
const int led = 7;
const int vout = 0;

//variable
//_
Float density, voltage;
int adcvalue;

//private function
//
int Filter(int m)
{
    static int flag, first = 0, _buff[10], sum;
    const int _buff_max = 10;
    int i;

    if(flag == 0)
        flag, first = 1;

    for(i = 0, sum = 0; i < _buff_max; i++)
    {
        _buff[i] = m;
        sum += _buff[i];
    }
    return m;
}

```

```

/*
convert voltage (mV)
*/
voltage = (SYS_VOLTAGE / 1024.0) * adcvalue * 11;
/*
voltage to density
*/
if(voltage >= NO_DUST_VOLTAGE)
{
    voltage = NO_DUST_VOLTAGE;
    density = voltage * COV_RATIO;
}
else
    density = 0;

/*
display the result
*/
Serial.print("MMMM");
Serial.print((density));
Serial.println("NNNN");
delay(1000);
}

```

```

var reset = function() {
  clearTimeout(timerToClose);
  timerIndex = 0;
  buttonClicks = 0;
};

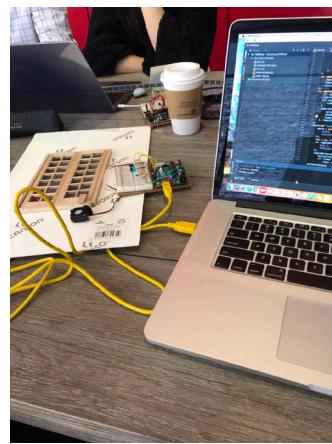
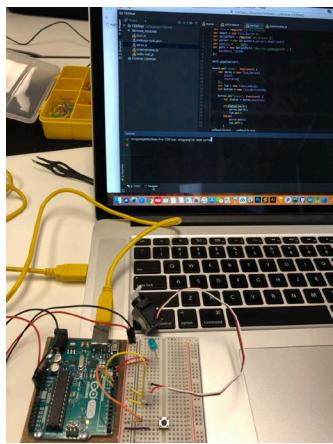
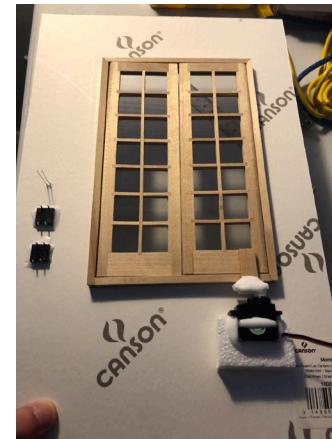
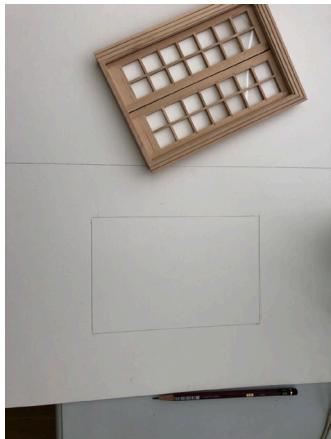
var setTimerToClose = function(){
  if(timerIndex > 0) { clearTimeout(timerToClose); }
  timerIndex++;
  if (timerIndex == 3) {
    timerIndex = 0;
  }
  timerClose = setTimeout(function(){
    servo[0].write(90);
    servo[1].write(90);
    timerIndex = 0;
    timerToClose = null;
    timerIntervalIndex++;
    timerIntervalIndex = timerIntervalIndex + 1000;
  }, 1000);
};

board.on("ready", function() {
  servo.attach(servoPin);
  servo.write(90);
  servo.attach(servoPin2);
  servo.write(90);
  start();
});

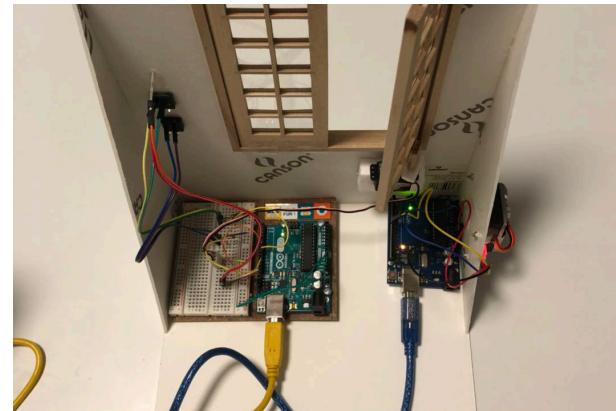
function start() {
  board.createLiveButton();
  var toggleButton = new five.Button({
    pins: 7
  });
  toggleButton.on("press", function() {
    if(buttonClicks % 2 == 0) {
      if(timerIndex == 0) {
        timerClose = setTimeout(function(){
          processCommand();
          reset();
        }, 1000);
      }
      var timerButton = new five.Button({
        pins: 10
      });
      timerButton.on("press", function(){
        setTimerToClose();
      });
      timerButton.on("hold", function(){
        clearTimeout(timerToClose);
      });
    }
  });
});

```

# PHYSICAL PRODUCT



## PHYSICAL PRODUCT PROTOTYPE



video demo: <https://www.youtube.com/watch?v=ApgaU26C0Bc>

**BRANDING DESIGN**

# BRANDING

## LOGO



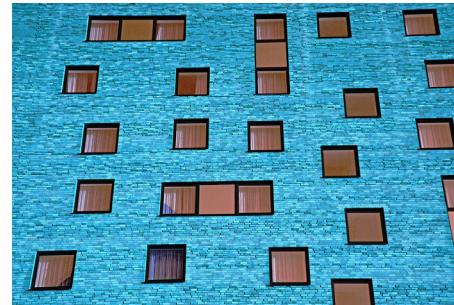
# BRANDING

LOGO B&W



# BRANDING

## MOODBOARD



# BRANDING

## COLOR PALETTE



C20 M16 Y16 K0  
R202 G202 B202  
#cacaca



C24 M5 Y3 K0  
R252 G228 B92  
#bddbed



C58 M7 Y0 K0  
R88 G189 B235  
#58bdeb



C72 M29 Y1 K0  
R61 G149 B206  
#3d95ce



C86 M53 Y29 K7  
R45 G106 B140  
#2d6a8c

# BRANDING

## TYPOGRAPHY

Aa

Muli

Light

ABCDEFGHIJKLMNOPQRSTUVWXYZ  
abcdefghijklmnopqrstuvwxyz  
0123456789!@#\$%^&\*()

Regular

ABCDEFGHIJKLMNOPQRSTUVWXYZ  
abcdefghijklmnopqrstuvwxyz  
0123456789!@#\$%^&\*()

Bold

ABCDEFGHIJKLMNOPQRSTUVWXYZ  
abcdefghijklmnopqrstuvwxyz  
0123456789!@#\$%^&\*()

## LIST RESOURCES

1. J.K. Dineen and Gwendolyn Wu, Nov. 16, 2018. Northern California air quality rated the worst in the world, conditions 'hazardous'[online]
2. Brock Keeling, Nov 17, 2018. San Francisco air quality remains 'unhealthy' at red[online]
3. T.F. O'Brien Cooling & Heating, September 1, 2010. The Importance of Good Ventilation [online]

## CONCLUSION

This project has actually helped me a lot. I got pneumothorax several years ago, so I pay special attention to air quality. Recent wildfires in California have made San Francisco's air quality once among the worst in the world. I also hope that more people can pay attention to the influence of air quality on our physical health through this project.

**mingyanglidesign.com**