PROJECT AIR FLOW

Supercomputing Challenge
Final Report
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Executive Summary

Living in a dormitory with no air conditioning with the heat outside unbearable, imagine what the conditions would be inside. To be short and simple we live in dormitories with no air-conditioning with the outside heat over ninety digress sometimes. We were suffering from the extreme conditions inside the dorm during the summers. That gave us an idea and that is where project air flow comes in. We had ideas about constructing devices capable of handling the heat and changing the temperature in the room to a desired more comfortable temperature. We aspired to cool the rooms of were we live.

We used three different techniques to the problem of cooling the rooms. We used three different fans. A fan built with ice included and one fan built without ice. The other fan was a consumer bought fan. We made a comparison with the three fans and looked for how fast the fan changed the conditions of the room to the desired temperature. We constructed graphs and tested each fan. Our thought was to find out which of the three fans would be the most efficient fan.

We used the Star logo program to simulate the hot and cold air particles that would be throughout the room. We used what amount of cold particles would effectively change the hot air particles inside the room. We ran different simulations to thoroughly find the ideal number of cold air particles to change the arrangement of the hot air particles.

Introduction

With are ideas for are project set in stone, we began to actually build and construct the fans for our data analysis. We began testing the three designs of fans. We analyzed each fan and made a graph for each of the performances. We researched different type of fans and how they cool things down. We then proceeded by researching the variables that fans face in usage. The research gave us the bases on were to put the ice more effectively on the fan and how to construct such contraptions. In the process of gathering out data we learned a great deal about graphs, analyzing, and the concepts of the fans cooling properties. We used all the information we learned and directed it to project Air-Flow.

Hypothesis

We believe the fan we built is capable of cooling a room faster than a consumer bought fan. We also believe that a time of 10 minutes is the amount of time required for the room to reach the desired temperature.

Explanation of Variables

In our program we use multiple equations to simulate what are fans are capable of doing. These equations consist of variables that can be confusing to one who has not studied them. This section is designed to thoroughly explain each variable.

The equation that we use for fan with ice is $Y= ax^2+bx+c$ with a= .0087181337, b= -- .7587662338, and c= .619047619. The Y represents the change in temperature and the x variable represents the time the fan cools the room to the desired temperature. The numbers the letters equal are the results of graphs we took from our data of our fans. We also came up with two other equations for the other two fans we are comparing. The fan that operates without ice has the same equation but with different numbers.(a = .0064935065, b= -.467027417, and c=1.654761905) The variables remain the same with y equals change in temperature and with x equals change in time. The numbers resulted from graph of data we came up with from that cools without ice. We did the exactly same thing with the consumer fan. The results we came up with are a= -.0058922559, b=-.2065656566, and c= 1.

Model

Our program for our project consists of Star Logo Computer Simulations

Initial amount of Hot Air Particles
Initial amount of Cold Air Particles
Final amount of Hot Air Particles
Final amount of Cold Air Particles
Changed Air Particles:
Projected Final Temperature:

The preceding steps are how star logo is used in the programming and simulates the cooling process in a room. We also used several equations with each fan.

The fan that cools with ice:

$Y= ax^2+bx+c$

a= .0087181337

b= -.7587662338

c=. 619047619

The fan that cools without ice:

$Y= ax^2+bx+c$

a= .0064935065

b= -.467627417

c= 1.6547619

The consumer fan

$Y= ax^2+bx+c$

a= -.0058922559

b=-.2065656566

c= 1

These equations are results from a graph that we took of each performance of a fan and converted them into equations. Further explanation see equations and variables.

Then we used Star logo a computer program that lets us simulate different situations. We use type of programming such as:

Command Center This programming gives our simulation its color particles of blue, yellow, and red. It also gives us the reaction that we want the particles to have if we change conditions in the simulation.

```
turtles-own [lastx lasty lasth]

;reaction 1: red + blue <-> yellow
```

```
to go
fd (temperature / 100)
rt random 10 lt random 10
grab one-of-turtles-here
[
if ((color = red) and ((color-of partner) = blue)) and ((random 100) <= reaction-1)
[setc yellow setc-of partner yellow fd 1 stop]
if ((color = blue) and ((color-of partner) = red)) and ((random 100) <= reaction-1)
[setc yellow setc-of partner yellow fd 1 stop]
if ((color = yellow) and ((color-of partner) = yellow)) and ((random 100) > reaction-1)
[setc red setc-of partner blue fd 1 stop]
]
end
```

observer command center This programming gives us our simulation.

```
globals [degred deggreen degyellow degblue degwhite number]
 ;global variables used in drawing pie graph

to startup
 plotid 2
end

to setup
  plotid 2
  clearplot
  setplot-title ""
  ca
  create-and-do reds [setc red]
  create-and-do blues [setc blue]
  create-and-do yellows [setc yellow]
  ask-turtles [setxy (random screen-width) (random screen-height)]
  setupgraph
end

to plot-colors
  pp1 plot count-turtles-with [color = red]
  pp2 plot count-turtles-with [color = blue]
  pp3 plot count-turtles-with [color = yellow]
end

to setupgraph
  pp1 ppreset setppc red ppd
  pp2 ppreset setppc blue ppd
  pp3 ppreset setppc yellow ppd
  setplot-yrange 0 250
  setplot-xrange 0 25
```

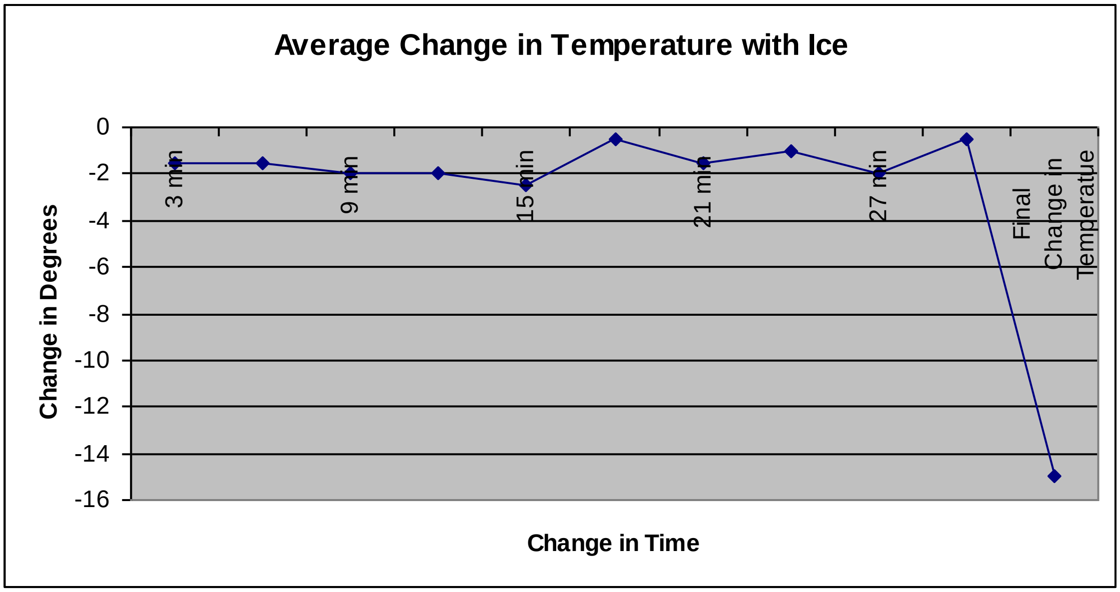
```
  setplot-title "Chemical Counts"
end



to draw-piechart       ;draw a pie graph of the colors
  setnumber count-turtles
  setbg black
  setdegred (numred * 360 / number) + 1
  setdegyellow (numyellow * 360 / number) + 1
  setdegblue (numblue * 360 / number) + 1
  ask-turtles
   [setlastx xcor setlasty ycor setlasth heading
    home
    if (color = red) [seth (random degred) + 1]
    if (color = blue) [seth (random degblue) + degred + 1]
    if (color = yellow) [seth (random degyellow) + deggreen + degblue + degred + 1]
    pd fd 20]
end

to go-back
  ask-turtles [ht pu]
  setbg black
  ask-turtles [setx lastx sety lasty seth lasth st]
end

to start
  startgobutton
  startplotbutton
end

to stopit
  stopgobutton
  stopplotbutton
end

;numblue, numred, numyellow, numwhite, numgreen
;are all used in the blues, reds, yellows, whites, and monitors
;these values are not the same as the slider values
;except immediately after setup

to numblue
 output count-turtles-with [color = blue]
end

to numred
 output count-turtles-with [color = red]
end
```

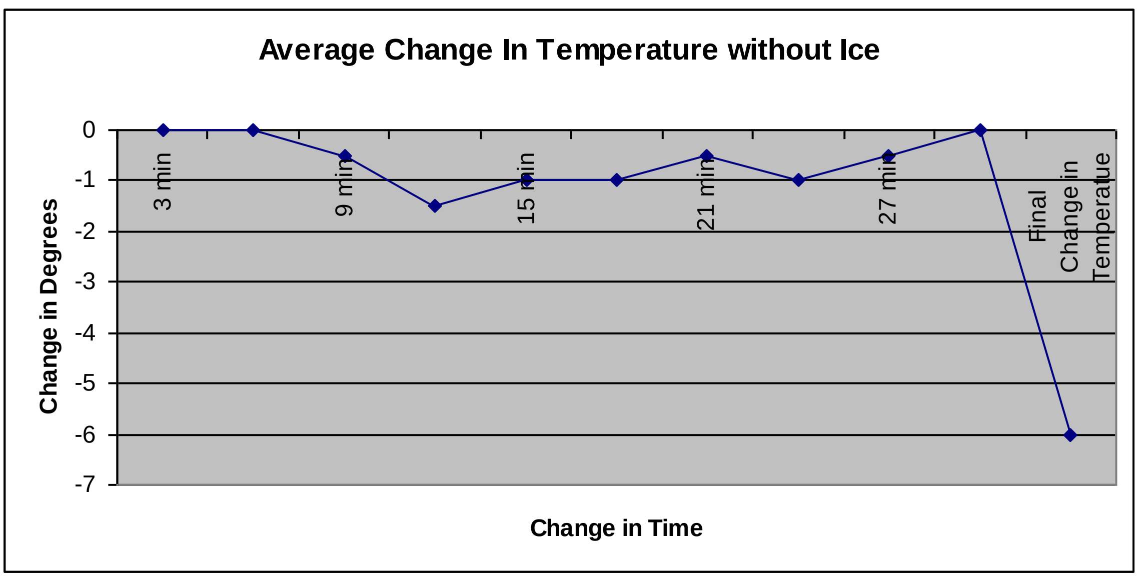
```
to numyellow
 output count-turtles-with [color = yellow]
end
```

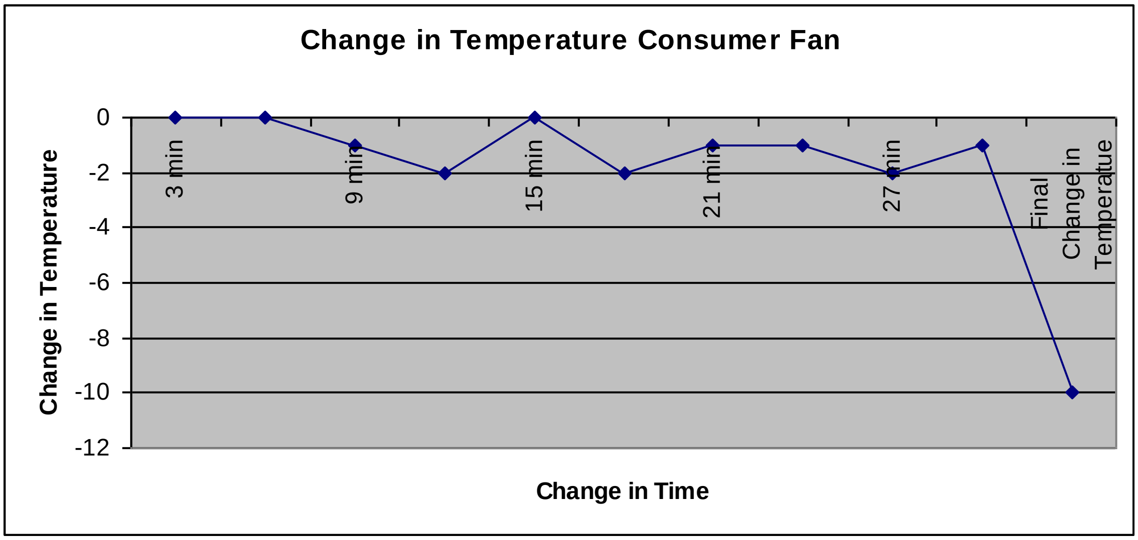
Method and Implementation

The procedures we took are simple and effective. Our whole team contributed to research from internet sites, books, and information from significant people, while one of our team members developed the program for our cooling simulations on Star Logo. The programming was a success with the programming being easy and efficient to use. We designed two fans one with ice and one without. Than we tested the different fans within a room and collected the results. We also ran simulations on our star logo program which gave us and idea about the different cooling times.

Results and conclusions







Star Logo Computer Simulation results

Star Logo Simulation #1

Cooling Simulation including Ice

Initial amount of Hot Air Particles: **500 particles**
Initial amount of Cold Air Particles: **86 particles**
Final amount of Hot Air Particles: **430 particles**
Final amount of Cold Air Particles: **20 particles**
Changed Air Particles: **141 particles**

Star Logo Simulation #1

Cooling Simulation excluding Ice

Initial amount of Hot Air Particles: **500 particles**
Initial amount of Cold Air Particles: **34 particles**
Final amount of Hot Air Particles: **469 particles**
Final amount of Cold Air Particles: **5 particles**
Changed Air Particles: **62 particles**

Star Logo Simulation #1

Cooling Simulation Consumer Bought Fan

Initial amount of Hot Air Particles: **500 particles**
Initial amount of Cold Air Particles: **22 particles**
Final amount of Hot Air Particles: **474 particles**
Final amount of Cold Air Particles: **1 particle**
Changed Air Particles: **52 particles**

Results

Cooling with Ice
$y = ax^2 + bx + c$

a = .0087181337
b = -.7587662338
c = .619047619

Local Minimum: **x** = 43.4 @ **y** = -17.13

Cooling without Ice
$y = ax^2 + bx + c$

a = .006435065
b = -.467027417
c = 1.654761905

Local Minimum: **x** = 35.96 @ **y** = -6.743

Cooling with Consumer Bought Fan
$y = ax^2 + bx + c$

a = -.0058922559
b = -.2065656566
b = 1

Local Minimum: **x** = 17.52 @ **y** = -4.4

Conclusion

After analyzing the data and acquiring results a discovery was made; each fan has a limit of changing the temperature in a room. Not all the methods of cooling a room had similar results but unique outcomes. The built fan in addition to ice is capable of cooling a room 17.13 degrees from an initial temperature in 43.5 minutes. The built fan excluding ice is capable of cooling a room 6.75 degree in 35.96 minutes. And a consumer bought fan is capable of cooling a room 4 degree in 17.52 minutes. The Built fan including ice had the best capability of cooling a room more effectively than both the built fan excluding ice and the consumer bought fan. Although none of the cooling methods cooled a room within 10 minutes each effectively made a change in temperature over a time.

Acknowledgements

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Bibliography

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