Final Analysis Conclusion

Tracking the Weather

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Introduction

This project was really fun to do and got more interesting as it went along. There were a bunch of little bumps in the data collection, those are noted in my reflection, and some of the data collection results are here and in the keynote. The research is evident in the keynote only. This conclusion is organized based on a few separate topics.

I did use this conclusions document as the foundation on which my keynote was formed, however, I continued to add information to it well after solidifying the content of the keynote. Therefore it is clear that there is more information contained within this document than is outlined in the keynote. The use of the repetition of certain informational supports is to provide multiple formats for all of the core components to my project as a way to make it all clear.

Weather Report Accuracy

The core driving question for this entire project was “How accurate are the weather reports that we trust daily?”. To truly answer this question I’ve determined that I’d need months of data spanning more than one seasonal transition (my data just barely tapped the transition from Fall to Winter in 2008) and data that is collected 24/7 (which due to certain limitations on the RCX hardware I can’t really do, see “RCX Hardware Description” for details).

But even with the inconclusive data I can conclude this project with a very complex explanation. You can’t live in the exact same place as where the weather is tracked! Therefore you only end up getting weather that is accurate as of the nearest airport (with the core exception of Personal Weather Stations that contribute to WeatherUnderground and maybe other weather channels). In such a situation the current weather near you will be slightly off from the weather where the data is tracked. The weather reports may be correct for where the data comes from and very far off for the weather where you’re standing.

So, the question of weather report accuracy remains an underlying question to this project that can’t be answered definitively. That may even be the case with months of data. I’ll consider my conclusion that the data is inconclusive and that the question itself may have been one that can only be answered with pondering that reveals the above complex answer and not a question capable of a straight answer.

Just Some of the Data That I Collected

I collected well over 1,000 data points during the data collection phase of this project, so these 24 data points of light percentages and 24 data points of fahrenheit temperatures (48 data points total in the below table) is barely scraping the surface of the mountain of collected data.

Date/ Time	Light (%)	Temp (F)
Oct 12, 2008 8:08 PM	32	73.5
Oct 13, 2008 12:03 AM	25	71.2
Oct 13, 2008 6:48 AM	27	68.9
Oct 14, 2008 6:55 AM	30	37.9
Oct 14, 2008 12:00 PM	92	66.7
Oct 14, 2008 5:10 PM	70	53.6
Oct 15, 2008 7:20 AM	50	45.8
Oct 15, 2008 12:00 PM	95	77.1
Oct 15, 2008 3:35 PM	84	57.5
Oct 20, 2008 7:25 AM	52	41.9
Oct 20, 2008 12:00 PM	83	88.1
Oct 20, 2008 4:10 PM	79	55.2
Oct 21, 2008 7:15 AM	39	31.9
Oct 21, 2008 12:00 PM	83	80.3
Oct 21, 2008 5:05 PM	76	51
Oct 22, 2008 7:20 AM	29	40.4
Oct 22, 2008 12:00 PM	76	44.2
Oct 22, 2008 4:10 PM	64	42.4
Oct 23, 2008 7:20 AM	35	42.9
Oct 23, 2008 12:00 PM	88	59
Oct 23, 2008 4:10 PM	77	56.1
Oct 24, 2008 7:20 AM	28	47.1
Oct 24, 2008 12:00 PM	80	52.5
Oct 24, 2008 4:20 PM	83	55.7

Temperatures Offset

Looking at the temperature data that I collected in comparison to the two data points taken from WeatherUnderground daily I noticed that some of the temperatures were off by 10+ degrees. Some data to back that up is provided here (all fahrenheit, first temp mine, second temp WeatherUnderground's):

- 73.2 to 63.1
- 44.4 to 65.3
- 45.5 to 41.5
- 66.7 to 48.8
- 45.8 to 46.1
- 60.6 to 53.1
- 53.9 to 44.9
- 59.9 to 53.1
- 45.1 to 38.6
- 52.3 to 48.9

There is one key possible reason for this that I've considered. That is that I didn't set up the sensor hardware to the exact specifications listed on the WunderWiki (WeatherUnderground's support site) for sensor placement. They have the following requirements for the temperature sensor:

- Never place it in direct sunlight
- Not blocked from wind
- At least 5 feet above rooftop or grass

In my case I had set up the temperature sensor literally years before learning those requirements and so here's how it was (and still is) set up for me:

- Attached on a long and thin cable
- Place just a foot or so outside one of my bedroom window

So the sensor is in:

- Direct sunlight that may even get amplified by the side of the house
- Blocked from some of the wind due to the house

All in all I feel as if the offset of data that was collected can be fully explained by the setup of the sensor. Some who read this may ask why I didn't re-setup my temperature sensor after learning the proper setup to mimic my online data. The reasons are simple:

- I had already started collecting data the incorrect way and wanted to stay consistent with the data collection location
- I didn't have the resources (long enough cable, way to prop up the sensor, etc.) to place it in the proper setup.

This fully accounts for the dramatic offset in data that was collected. As I can't recreate the proper setup I'm stuck with the data that I already have, but that's not a problem. On average the collected WU temperatures are 2-20 degrees off either hotter or cooler. So, I can just take that into account when I'm performing further analysis.

Data Collection Statistics

Here are some basic statistics on the data logging that I did myself to illustrate just how much data got collected and over how much time. The data was collected over portions of 9 nonconsecutive days. There ended up being 98.7 hours (4.11 days) in which 1,200 data points of light percentages and 1,200 data points of fahrenheit temperatures were collected (2,400 data points total). The data points were collected every 5 minutes (300 seconds).

RCX Hardware Description

The hardware that I used to do this data collection was not at all what a professional would consider anywhere near the right hardware to use. I used something that is technically manufactured and marketed as an toy. What I used is a Lego Mindstorms RCX. I got the version that is designed for science teachers (which I got nearly 3-4 years ago by now), so at least it was designed for data collection as well as robot creation.

The kit came with (among many other things) the RCX brick (computer built into a large lego brick), a temperature sensor, a light sensor, a touch sensor, a power adapter for the RCX (though it also can run off of 6 AA batteries), the Robolab v2.9.4 software, a remote control, a USB Communications Tower, some motors (not used for this project), and a bunch of wires to connect the sensors and motors.

There are some key disadvantages to this setup. Aside from the obvious ones (it being just loosely able to perform the task {though it performed it well}, the un-professional feeling when doing the data collection, etc.) it also has some annoying issues when used in my configuration. First off, the RCX's memory is such that it needs a sustained stream of power in order to keep the data that is in it's memory. So, without AA batteries in the RCX it would loose the FW, the Program, *and* the data sets in the event of a power outage. Therefore I had batteries inserted as a backup in case of an outage of any kind (and there was a power outage during one session). Secondly, the Robolab v2.9.4 software is designed for the older generation of Macs (Power PC-based Macs). That meant that whenever I ran the software my Mac (of the newer generation, Intel-based) it had to actually emulate that PPC CPU (thus slowing down the entire Intel-based OS and running it's internal fans quite loudly to compensate for the CPU overloading) and therefore some features were lost (proper trackpad scrolling, BT communication, certain saving and exporting options, etc.). Of course, the software and FW being based on National Instruments' Labview v8 (a powerful application package) kind of makes up for all of the disadvantages.

Overall it really isn't a question that I wasn't doing this data collection with the best practices that I could. But there are some basic reasons to justify this:

- The idea for this project came partly from wanting to use my RCX for a project
- Any more professional setup would have been quite costly
- I wasn't even striving to do a professional job at this data collection

Based on those reasons and other smaller ones it is clear that this project was done to the extent that it was set out to be, but no further.

Cause-and-Effect

I've been through this whole project and it seems to me that I have yet to touch directly on the two major elements of the standard trying to be achieved. The standard states to explain the cause-and-effect of the atmospheric and hydrologic processes of Earth. The atmospheric cause-and-effect is pretty well explained and proved with just the data that I collected and the analysis in the earlier parts of this text. The basic fact is that pressure and temperature changes determine wind and cloud properties that then, in turn, determines the weather for any given point on Earth. The hydrologic cycle is a core component to the atmospheric cycle. Mainly referred to as the water cycle, it is the cycle that explains and defines the movement of water. Clouds are formed of water, and there is the connection between the cycles. Causes and effects of these combined cycles are primarily the same pressure and temperature changes that initially made up the atmospheric cycle.