Outside Temperature/Humidity logger

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This is another WebControl 8 project. It provides real time web reporting of outdoor temperature and humidity as well as min/max temperature for the previous couple of days.

Overview

We have a very old Davis Weather Monitor station with software that updates temperature information on our internal web site. That no longer worked after I upgraded our computers to Windows 10. As much fun as it was having a personal weather station found we never used it for much other than checking overnight low temperature when we were concerned about first frost of the season or just to complain about how cold it was.

I decided to use another WebControl 8 PLC to create a data logger and post the information on our internal web server. That way the information is locally accessible from any networked device. For security reasons have not made the information remotely accessible but it I ever need to do that will set up a VPN.

Real time temperature/humidity

For real time outdoor and inside temperature/humidity we purchased several ThermPro TP-60 wireless units. They have been very reliable and are pretty cheap. I installed a single transmitter in the weather station radiation shield for accurate reporting and located several displays around the house.

The downside is the lack of easy to use min/max temperature logging and you have to go to one of the indoor units to view temperature and humidity.

PLC data logger

I've used a bunch of these [WebControl 8](#) programmable logic controllers for other home automation projects so decided to use it as the basis of the temperature logger. Unlike my other projects there is no additional electronics so I was able to use the off the shelf WebControl chassis to house the controller.

The controller is located near our Ethernet switch powered by a 9 volt SMPS wall wart. I used 4-pair Category rated cable to remote the temperature and humidity sensor. Each sensor only needs 3 wires each so I doubled up on grounds.
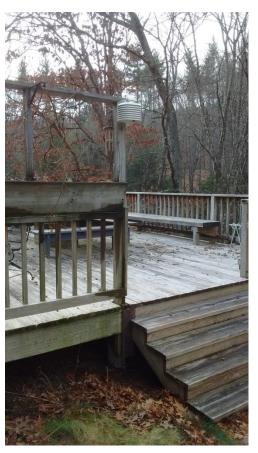
The temperature sensor is [Maxim 18B20](#) digital sensor and the humidity sensor is an analog [Honeywell HIH 4000](#). Both are readily available on eBay.

The web interface displays today's min/max temperature and min/max for the previous couple of days. The daily update is done at 6AM to better account for overnight temperature changes. The system

sends out a daily email as part of the 6AM update. It also sends an email if the temperature sensor has a hard failure.

Outdoor radiation shield

For accuracy the temperature sensor must be protected from direct sunlight and surfaces that radiate heat. I used the radiation shield from our old weather station mounted on the north side of a deck post about 12 feet from the west side of the house. The purpose of the radiation shield is to allow the free flow of ambient air while shielding the sensors for direct sunlight.

I attached a 6-postion screw terminal strip to the top of the radiation shield to mount the temperature and humidity sensors.

The shield houses both the WebControl 8 temperature/humidity sensors and the ThermPro wireless transmitter. Having two distinct systems quickly indicates problems.

It is interesting to see how effective the radiation shield is. We have another outdoor temperature sensor used by the greenhouse and mounted on the north facing wall of the house about 30 feet from the radiation shield. It is affected by the thermal mass of the house. During rapid temperature swings the two sensors differ by several degrees.
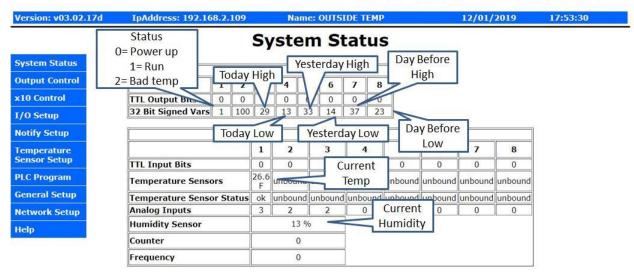
Radiation shield mounting recommendations:

1. Locate away from fences, buildings, trees or other obstructions that interfere with air flow
2. Install over plants or soil to limit heat radiation
3. Do not install over sprinklers, the shield is not designed to protect from water sprayed upward
4. If attached to building preferred location is on the north side in the Northern Hemisphere.
5. Locate temperature sensor 4-6 above the ground

Web Interface

The WebControl web interface is not very beautiful. One of the items on my to-do list is to write some web server code to integrate all my DIY home automation widgets to make the information easier to read.

Cost rollup

I used items I had laying around for this project. If you purchase everything new here is the expected cost.

Item	Cost
CAINetworks WebControl 8	$37.50
WebControl metal chassis	$15.00
6-postion Jones terminal strip	$2.00
Maxim 18B20 Temperature sensor	$1.00
Honeywell HIH 4000 Humidity sensor	$14.00
9V 1A Wall wart	$5.00
AcuRite 06054M Radiation shield	$21.00
Cat 5 cable	A/R
Total	$95.50

Firmware

Outside Temperature/Humidity Monitor

T. Schmidt

*********** Change Log ********************

11/25/2019	Added another day to temp history log, current day and two previous as of 6AM standard time. Divided temp by /10 displayed in VARs to display in full degrees F.

Ordered Honeywell HIH-4000-003 humidity sensor on eBay. Other then that had all the other parts on hand.

Installed system. Controller located on top of 16-port gig switch. Sensors installed in Davis Weather radiation used with the old Davis Weather stuff. Used Cat5e cable, doubled up on grounds since only 6-conductors are needed. Added aluminum plate on the top of the shield to attached 6-position Jones screw terminal.

Temp sensor +5V screw terminal does not work, ran temp and humidity +5 to the humidity terminal block.

11/24/2019   Code start

11/22/2019   Davis Weather Monitor II Ambient Weather web software does not play nicely with Win 10. The only thing I use the weather station for is to display min/max outdoor temperature. Plus I don't have the outdoor humidity sensor module, so cant track outside humidity.

Project based on an old WebControl8 board I pulled from greenhouse controller. Updated greenhouse WebControl to new hardware with SMPS so I could increase system voltage to 12V for humidity exhaust fan.

System monitors outdoor temperature and humidity. Sensors are located in the weather shield I had used for the Davis gear. Firmware records daily min/max and two previous day's min/max temperature. At 6AM sends email with the result.

11/22/2019   Project start

*************** PCB Hardware/Firmware version ***************

Hardware: 2.2.2
Firmware: 3.02.17d
Static IP: 192.168.2.109

Customer loop executed every ~50ms (minimal test code)
VAR and RAM initialized to 0 by system at power up
To reset PLC to power up state - update network settings (Send)
RAM location reset to 0 on code upload, VAR not affected
WebControl takes about 400ms to init I/O at power up
Per CAI Support Temp sensors take up to 2 sec to stabilize at power up
Email takes about 1.5 sec to send, no timeout if SMTP server does not respond
TTL inputs have 10k pulldown
Output buffers 10mA per output, 30mA total
A/D 10V full scale 10-bits

9V power consumption:
        WebControl board: 120ma (Live Ethernet serving web page)

**************** I/O Defs ********************

Analog Inputs

AIP1 - not used
AIP2 - not used
AIP3 - not used

Digital Inputs

IP1 - not used
IP2 - not used
IP3 - not used
IP4 - not used
IP5 - not used
IP6 - not used
IP7 - not used
IP8 - not used

Digital Outputs

OP1 - not used
OP2 - not used

OP3 - not used

OP4 - not used

OP5 - not used

OP6 - not used

OP7 - not used

OP8 - not used

Temperature Sensors

T1 - Outside Temperature

T2 - not used

T3 - not used

T4 - not used

T5 - not used

T6 - not used

T7 - not used

T8 - not used

Temp Sensor status (1 = OK)

TS1

TS2

TS3

TS4

TS5

TS6

TS7

TS8

Humidity Sensor

H1 - Outside relative humidity

Email message Identifiers

EM1 - System status (init and temp hard failure)

EM2 - not used

EM3 - not used

EM4 - not used

EM5 - not used

EM6 - not used

EM7 - Morning daily status email (6AM)

EM8 - not used

Variables

VAR1 - System Status: 0 power up, 1 normal, 2 bad temp sensor
VAR2 - Bad temp Sensor state: 0=send email, 1-100 debounce counter, 101=email sent
VAR3 - current day max temperature in degrees F
VAR4 - current day min temperature
VAR5 - previous day max temperature
VAR6 - previous day min temperature
VAR7 - 2nd day max temperature
VAR8 - 2nd day min temperature

RAM

RAM1 - T1 Temp /10
RAM2 -
RAM3 -
RAM4 -
RAM5 -
RAM6 -
RAM7 -
RAM8 -

Web constants

UROM1 - not used
UROM2 - not used
UROM3 - not used
UROM4 - not used

****
PUINIT

      Runs once at power up. Delay for temp sensors to stabilize and sets VAR1
      status flag =1

OUTTEMP

      Fetches current temperature and sets current day min/max. Debounces bad temp
      status and sends email if hard failure.

NEWDAY

      Sends email at 6AM (std time) with current temp/humidity and min/max value

for previous two days.

****************** Code ***********************

```
START
        TSTEQ  VAR1 0
        CALLSUB PUINIT
        CALLSUB OUTTEMP
        CALLSUB NEWDAY
        DELAY  1000
END


PUINIT:
        SET     VAR1 1
        SET     VAR2 100
        DELAY  3000
        CALLSUB TEMPSTAT
        TSTNE  VAR2 100
        GOTO   PUINIT1
        DIV     T1 10 RAM1
        SET     VAR3 RAM1
        SET     VAR4 RAM1
PUINIT1:
        EMAIL  EM1
        RET


OUTTEMP:
        CALLSUB         TEMPSTAT
        TSTNE  VAR2 100
        RET

        DIV     T1 10 RAM1
        TSTGT  RAM1 VAR3
        SET     VAR3 RAM1
        TSTLT   RAM1 VAR4
        SET     VAR4 RAM1
        RET


NEWDAY:
        TSTNE  CH 6
        RET
```

```
        TSTNE   CM 0
        RET

        SET     VAR7 VAR5
        SET     VAR8 VAR6
        SET     VAR5 VAR3
        SET     VAR6 VAR4
        DIV     T1 10 RAM1
        SET     VAR3 RAM1
        SET     VAR4 RAM1
        EMAIL   EM7
NEWDAY1:
        TSTEQ   CM 0
        GOTO    NEWDAY1
        RET


TEMPSTAT:
        TSTEQ   VAR2 101
        RET

        TSTNE   TS1 1
        GOTO    BADTEMP
        SET     VAR2 100
        RET


BADTEMP:
        DEC     VAR2
        TSTNE   VAR2 0
        RET

        SET     VAR1 2
        SET     VAR2 101
        EMAIL   EM1
        RET


****************** End ***********************
```

Parting thoughts

It is nice being able to read outside temperature from any web enabled device at home and observe the min/max readings for the last couple of days.