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Temperature monitoring with Linux

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About the author:

Being a trained electrician, I found myself in 1990 in front of a CAD workstation to develop a switch and control station. Obviously, I got infected by a then unknown 'virus', and that's just fine.

Translated to English by:
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Abstract:

Abstract: Linux server are performing their job reliably and safe, they don't need any special attention, they run and run and run... But what happens if the little penguin is getting too hot? The past summer did show us: we should give to our little friend a temperature monitoring system. This article will show you how to install one with little effort for about 10 Euros.

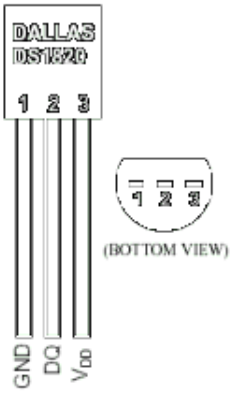
The Components

Brian C.Lane has written a program for the temperature sensor DS1820 from DALLAS Semiconductor It is not hard to assemble a temperature monitoring system with these two components and a handful of other parts.

Note:
Brian C.Lane has modified his page and discontinued the version I used. You can therefore download it from here: digitemp-1.3.tar.gz

Those of you who want to use his current version*digitemp-3.2.0.tar.gz* can download it from http://www.digitemp.com/software.shtml .

The Sensor



The sensor was originally produced by DALLAS Semiconductor which has merged to Maxim/Dallas Semiconductor. According to the data specification the sensor can measure temperatures from -55°C to 125°C. The measurement data are generated as a digital signal with a width of 9 bits. In addition each sensor owns a 64 bit I.D. number, allowing to interface (bus) a number of sensors. It is possible to utilize 100 sensors on a bus of a length of 300m .
The circuit we are presenting here shall work with only 10 sensors on a bus of 60m. I am using at present 4 sensors on a bus of about 12m.

You can find more information about the sensor in this Spec Sheet.

I want to add that the circuit presented here can measure only up to 75°C, which should be adequate for our application.

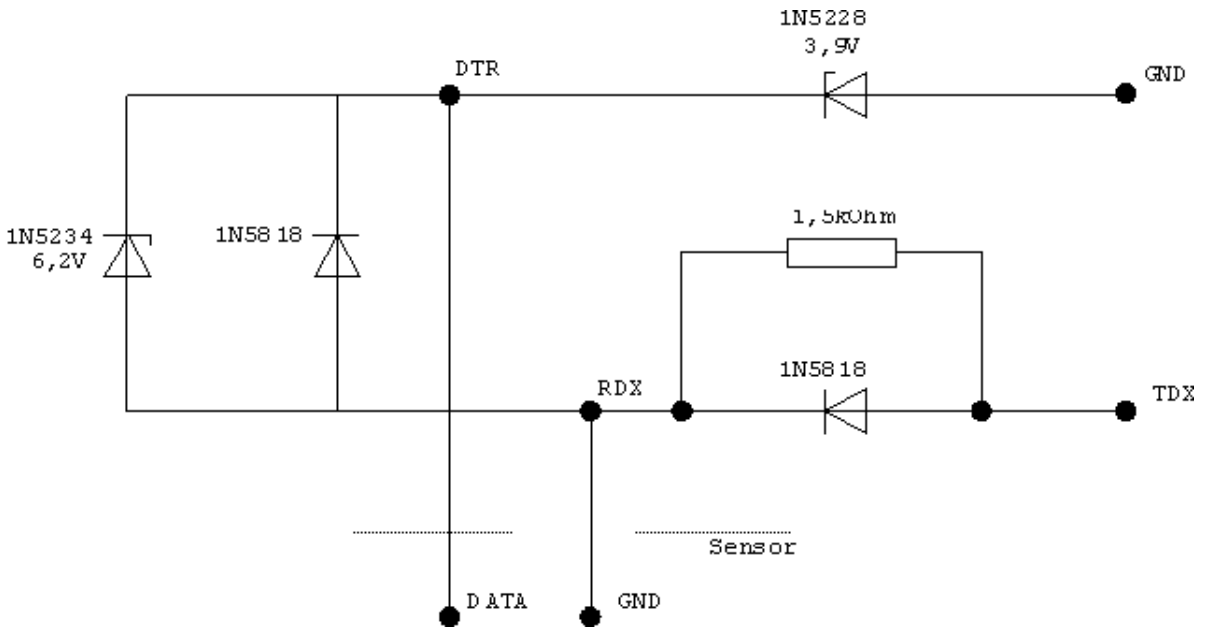
The Other Components

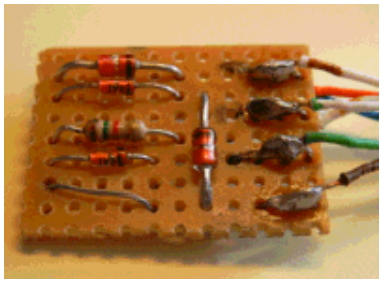
To be able to connect the sensor to the serial interface we need additional components. You will find them at most of the retailers of electronic parts, in the internet or -even better- in the electronics store around the corner.

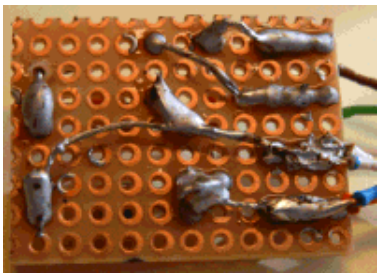
Quantity	Identification	Type	alter.Type
1	Resistor	1,5 k Ohm	--------
2	Schottky Diode	1N5818	BAT 43
1	Zener Diode	1N5228	ZPY 3,9V
1	Zener Diode	1N5234	ZPY 6,2V
1	Sensor	DS18S20	--------
1	Socket, Serial	RS232C/9	--------
1	Connector Shell	SUB-D/9	--------
1	Breadboard	Laminated Paper	--------

Design of the Interface

Since the interface circuit is very simple I choose to assemble it on a breadboard. Sorry for my soldering artwork :-).







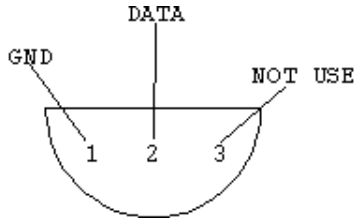
With some skills the components can be installed in the plug of the serial interface.

Note
On this page of LinuxNetMag we can find an article on *digitemp*, also a forum describing a circuit for measurements above 75°C. I have not yet testet that circuit.

The Circuit of the Serial Interface

For our interface circuit only two contacts of the sensor are required, the connector V can be

For our interface circuit only two contacts of the sensor are required, the connector V_{DD} can be removed. I simply snipped it off :-).



Here is a table of the circuit of the interface card, the sensors and the serial interface.

Description	DB-25	DB-9	Sensor
DTR	20	4	Data (PIN 2)
RXD	3	2	GND (PIN 1)
TXD	2	3	
GND	1 and 7	5	

Installation of the Software

The software is available as a *tar* archive, it can be installed with the command:

```
 tar -xvzf digitemp-1.3.tar.gz
```

in the current directory.

In the newly installed directory **`digitemp1-3`** we find the source code, documentation and some Perl scripts, but also the binaries **`digitemp`**, which can be used as they are.

If `digitemp` is invoked without parameters we will get an overview of the parameters presented.

```
DigiTemp v1.3 Copyright 1997-99 by Nexus Computing

Usage: digitemp -s<device> [-i -d -l -r -v -t -p -a]
                -i                          Initalize .digitemprc file
                -s/dev/ttyS0                Set serial port
                -l/var/log/temperature      Send output to logfile
                -f5                         Fail delay in S
                -r500                       Read delay in mS
                -v                          Verbose output
                -t0                         Read Sensor #
                -a                          Read all Sensors
                -d5                         Delay between samples (in sec.)
                -n50                        Number of times to repeat
                -o2                         Output format for logfile
                -o"output format string"    See description below

Logfile formats:  1 = One line per sensor, time, C, F (default)
                  2 = One line per sample, elapsed time, temperature in C
```

```
          3 = Same as #2, except temperature is in F
#2 and #3 have the data seperated by tabs, suitable for import
into a spreadsheet or other graphing software.

The format string uses strftime tokens plus 3 special ones for
digitemp - %s for sensor #, %C for centigrage, %F for fahrenheight.
The case of the token is important! The default format string is:
"%b %d %H:%M:%S Sensor %s C: %.2C F: %.2F" which gives you an
output of: May 24 21:25:43 Sensor 0 C: 23.66 F: 74.59
```

As ’Help’ tells us the installed sensors need to be initialized. For this we need to define the interface to which our circuit is connected, as well as the parameter for the initializing.

The command

```
digitemp -i -s/dev/ttyS0
```

accomplishes that, in this case the interface circuit is connected to the first serial interface.

The software detects the sensors, a message similar to this appears:

```
DigiTemp v1.3 Copyright 1997-99 by Nexus Computing

ROM #0 : 1032724700080086
ROM #1 : 1092214400080089
```

We notice that the software detected 2 sensors. In addition the file **`.digitemprc`** will be created in the current directory, it will contain the data of the sensors, the interface and the output format.

With the command **`./digitemp -a`** we are now able to read the output of the sensors. Please note the **`./`** character, we are still in a directory which is not part of the current search path.

Measurement Output

```
DigiTemp v1.3 Copyright 1997-99 by Nexus Computing

Sep 24 21:53:35 Sensor 0 C: 37.94 F: 100.29
Sep 24 21:53:38 Sensor 1 C: 10.62 F: 51.129
```

Adapting the System

To integrate our program into our system we need to do a few adjustments.

First, we need to copy the binaries, e.g. `digitemp`, in a directory which allows the execution of programs without path definition. I selected`/usr/local/bin/` for this. Those who are not sure about this can find the paths with **`echo $PATH`** . Furthermore, the file `.digitemprc` with the initializing data needs to copied to the home directory of user who carries out the measurements. To save the data in a file and not on the console the switch `-l[PATH/FILE NAME]` needs to be applied.

Automatic Measurements

Now we need to automatize our measurements, the well tried *cron* will do that. With **`crontab -u [USER] -e`** we can set this up for every user. The entry

```
0-59/15 * * * * /usr/local/bin/digitemp -a -l/var/log/digitemp.log
```

initiates digitemp to execute a measurement every 15 minutes and to write them to`/var/log/digitemp.log`.

With the command `tail /var/log/digitemp.log` we can read the last lines of the measurements. If the file `/var/log/digitemp.log` is not being generated, please have a look at the file access rights.

Closing Comment

The archive contains a few Perl scripts for the graphical interpretation. I am not going to describe them here. I am pondering the idea to write another article on how to collect sensor data in the data base mySQL and how to interpret them through a web interface.

This will mainly be done with Perl by using the function mySQL, CGI, graphic.

Download

- digitemp-1.3.tar.gz

Links / References

- http://www.fli4l.de/ - fli4l Homepage
- http://www.perl.org/ - Perl Homepage
- General Overview DS1820
- Spec Sheet DS18S20
- Brian C.Lane’s Digitemp Page
- Brian C.Lane’s Homepage
- Homepage Maxim/Dallas Semiconductor
- LinuxNetMag Article und Forum

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