Temperature measuring and information distribution through central antenna system

Final Year School Project - Presented on 7th of May, 2002
Pori Technical School, Department of Electrical Engineering
Graded kiitettävä/K5 (equivalent to an A)

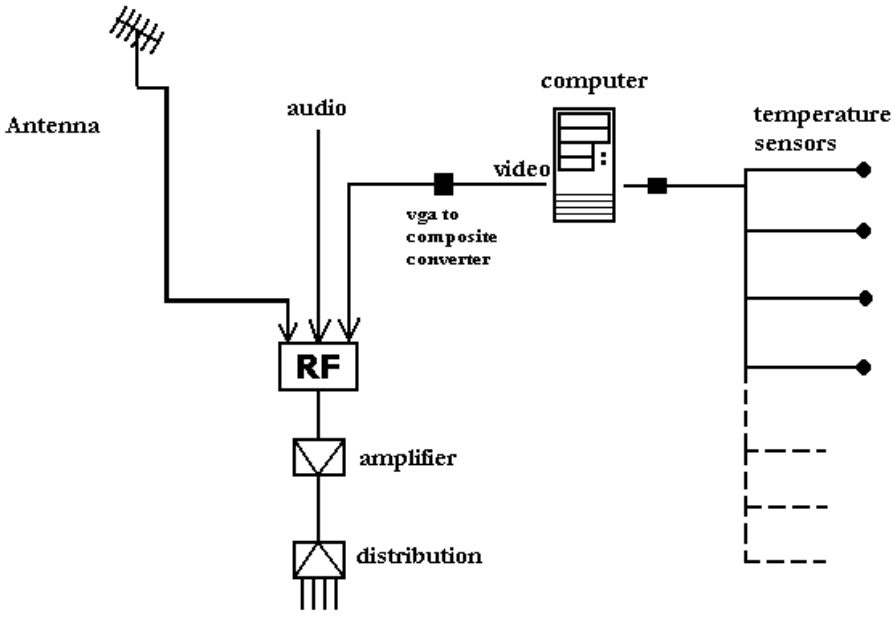
The original documentation of over 10 pages is only available in Finnish.
The following is a summarized description of the project.
There's also a Finnish version of this summary available, also with errata and addendum report on the original documentation.

Project summary

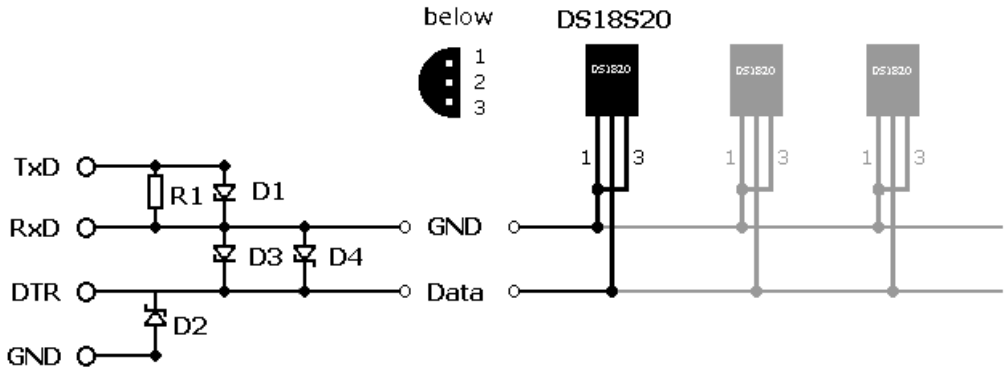
Project's main goal was to create a system that enables me to view several temperatures (outdoor, indoor, sauna etc) from television sets (and computers) around the house instead of having to walk to the appropriate thermometers.

Main parts of the system are (#1) reading the temperatures on a computer and (#2) the distribution of the information - i.e. (within/as the) pc's video signal - to the television antenna network. The temperatures are read by Dallas Semiconductors' hardware; DS18S20 temperature sensors and a adapter which converts 1-wire LAN protocol (used by the temperature sensor) to RS232 protocol(used by PCs' serial port). The sensors are plugged into the adapter and adapter is connected to the computer's serial port. 1-wire LAN is Dallas Semiconductors' own network protocol used by various small devices, such as different sensors et al.
The sensors, adapter and the wiring can be bought from iButton.com as finished parts ready to be used and plugged, but I prefered building the system parts myself - all but the sensors.

System diagram



Adapter schematics



pins	DB-9	DB-25
TxD	3	2
RxD	2	3
DTR	4	20
GND	5	7

Required parts

R1	1.5 kΩ resistor		
D1, D3	Schottky diode	BAT85	
D2	Zener diode	BZX55C3V9	3.9 v, 500 mW
D4	Zener diode	BZX55C6V2	6.2 v

Information redistribution

Because the computer's VGA signal cannot be directly distributed through the antenna network, it must first be converted and/or modulated to an acceptable form. Finally the signal is sent to a RF modulator which modulates the video signal on its "own" television channel, which can be tuned on television sets, like any channel from aerial antenna/terrestrial cable feed.
The RF modulator doesn't accept VGA signal, so it must first be converted into composite video signal using the computer display card's tv output or an external *scan converter*, like Askey Scan Converter. There are also some guides online on how to construct a scan converter.
In the RF modulator I used there's also audio input for stereo sound, so you can also modulate sound on the same tv channel, so it's not boring just to at the temperatures information on tv sets. For instance you could make an hours long playlist on Winamp and play music on the television channels.
An active user/programmer could make a html page or similar (which is then viewed on a computer/server and distributed through the antenna network) displaying all sorts useful information besides the temperature, like the weather outside (downloaded from an online RSS or by using a home weather station) or eg. by viewing imagery from a webcam.
Dullest way to show the information is to run a graphical program, such as iButton-TMEX to view the temperatures, but for example using MySQL with Digitemp extensions you can make interesting diagrams and more impressive presentations.
Also, the possibilities of a http server...

At my house the audio and video signals are sent from the computer room to the distribution cabinet using Cat5e paired cable; one of the pairs provides a phone line, another pair for the video signal and two for the audio signals (left and right channels).

However, the distribution system at my house isn't currently at use, since I don't have a PC/server I could dedicate to the task 24/7.

Adapters and the temperature sensors

Software for reading the 1-wire LAN thermal sensors can be found on Brian Lane's Digitemp page. On his page is also more thorough information on building the adapter, links to useful data sheets and design documents. Dallas Semiconductors also has some software (iButton TMEX), which I use.

As you can see from the circuit diagram the adapter is a simple device consisting of only a few basic electrical components (diodes and one resistor) and is easily constructed.

The Adapter version #1. The adapter is connected to the computer with a normal m-f serial cable and the

sensors are connected to the adapter using 3.5 mm mono audio connectors.



The Adapter version #2 and DB-9 version of the adapter. Both built sometimes in the autumn of 2003. I used the same case model as with the first version, but in black. I also added a switch which can be used to switch the adapter function off. This way several adapters can be connected together to be used as hubs.
As you can see from inside the case, the electronic components take little space, and therefore can be fitted inside a db-9 female connector, which can be directly plugged into a computer. Only limitation in the DB-9 version is its single 3.5 mm connector. That's when the bigger adapter's 'hub function' comes in handy.
In the second picture from the right the small object besides the db-9 adapter is a 3.5 mm connector which has a sensor in it.