

# NetSys Functional Description

Date: October 27, 2005  
To: Dr. Anakwa  
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Subject: Functional Description of Network Embedded Heating and Air Conditioning System

## Introduction:

The Network Embedded Heating and Air Conditioning System is a component of a home automation system. A user will access a web-based interface to view current temperatures of various rooms in a home, and the user will be able to change the desired temperature at the heating and air conditioning controller using the same web-based interface. The home will be split into separate zones, which the device will control separately. These zones can be split by room or floor, or however the air ducts are installed. The controller will control the separate temperatures in the zones using electronically controlled dampers which limit heat or air conditioning flow to a room. The significance of the project is that the network embedded controller can be programmed for many different devices in a home automation system, although this project only shows one of the uses of the controller.

## Description:

### *Block Diagram:*

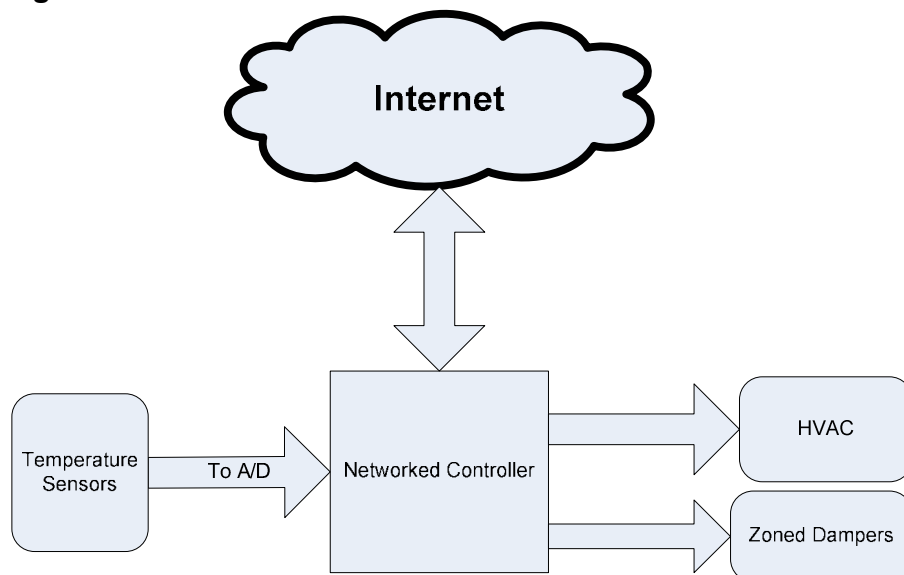


Figure 1: High level block diagram of the networked heating/air conditioning system

The microcontroller that is being used is a Motorola MCF5282 Coldfire Microcontroller. A CML-5282 is the development kit that will be used, and it has all of the necessary components included. The microcontroller will run a RTXQ Quadros Real-Time Operating System.

### ***Inputs and Outputs:***

Disregarding the network connection, the only inputs to the system are the temperature sensors. These will be placed in various locations and the input voltages will be read off of the A/D converter on the networked controller. In a home situation, the sensors will all be in different locations around the home. There will be several outputs to the HVAC. These will be described later, but they will tell the HVAC when to heat, cool, and turn the fans on and off. Finally, there are outputs that go to zoned dampers. These will open and close the air flow to specific parts of a house.

The network connection will act as the input/output from the network. The device will be running software that will act as a network server so that a user can log into the device and view current temperatures and modify the temperatures in various areas of the home.

### ***Functional Modes of Operation:***

The embedded device will serve two purposes. It will act as a web server and a network device to send and receive information over the internet, and it will also serve as a heating and air conditioning controller. A diagram that shows the basic function of the device is shown in figure 2, and is explained below.

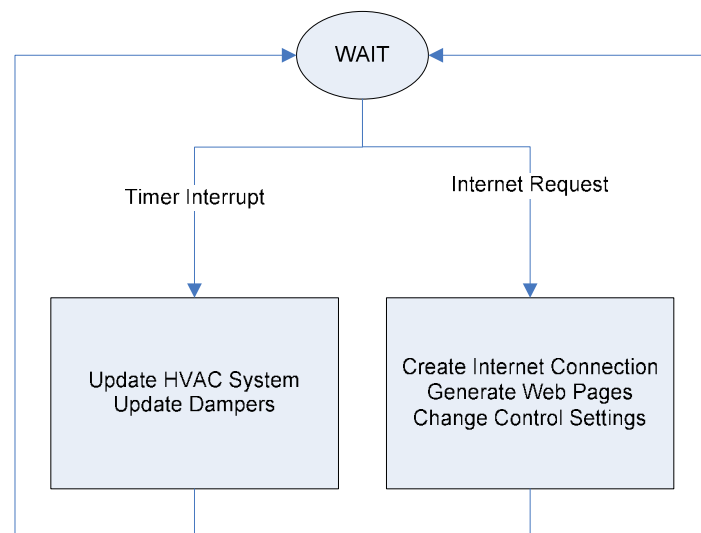


Figure 2: The Basic Functional Diagram Describing the Modes of Operation of the Network Embedded Controller

### **HVAC Controller:**

While the device is acting as an HVAC controller, it will monitor the current temperature in the different zones. The HVAC controller will have 3 modes: Heat, Cool, and Off. In

those three modes, the controller will compare the current temperature with a desired temperature in all the zones. If there is a difference, the device will send a signal to the furnace or air conditioner to turn them on if it is in the heating or cooling mode. It will then monitor the temperature in each zone. If there is a difference in temperature in a specific zone, then the device will send a signal to that zone's damper to open it. If it is running in the off mode, the device will monitor the temperatures, but it will not send signals to turn the furnace or air conditioner on. There will be external hardware to convert the signal from the system into a twenty volt signal that will control the furnace, air conditioner, and dampers.

**Network Device Controller:**

Along with the HVAC controller, the embedded device will also run as a web server. In this mode, the controller will wait for another computer or device from the internet to request a connection from the server. The device will create the connection, and then send the other computer a web page that is stored in local memory. To create this web page, the current temperatures will be updated according to the temperatures that were taken by the HVAC controller. Also, the web server will display the desired temperature and will have options on the web page to control the desired temperature in each zone.