Wireless Thermostat

Abstract
The wireless thermostat system consists of a base station, which communicates through Radio Frequency (RF) with remote thermostats to control heaters in separate zones. The wireless thermostat will be easily installed to replace existing manually controlled thermostats by utilizing the existing control wiring. The entire system will be expandable so the user can purchase remote units to correspond to the number of heaters found in the house or apartment. The base station will display the current temperature in each zone, which has a remote unit installed, and the base station will contain a thermostat to be the first zone of the system.

Description

The base station will consist of a microprocessor, a wireless module, a temperature sensor, a Liquid Crystal Display (LCD), and a keypad. The base microprocessor will control all of the functions in the base station. The base station will be responsible for telling the individual zones to turn on when their temperature drops below the set value. There will be a hysteresis loop to keep the heater from turning on and turning off continuously. The wireless module will be used to communicate with the remote sensors in the different zones. The display will show the

current temperatures in each zone. The keypad will be used to select a zone and set the desired...
temperature. The temperature sensor on the base will input into the microprocessor to detect the
temperature in that zone. The base station will be powered through an Alternating Current (AC)
to Direct Current (DC) adapter. The current temperature settings will be stored in non-volatile
memory, so that following a power outage the system will continue to run as previously
programmed.

The remote station will consist of a temperature sensor, a
microprocessor, a LCD, and a wireless module. The temperature
sensor will input into the microprocessor, which will send the
information to the wireless module. The wireless module will
communicate with the base station by sending the current
temperature information and will receive the command to turn on the
heater. There will be an LED to display the RF status. This LED will
be flash on and off quickly when there is a link with the base station.
The LCD will display the current temperature. A button will be used
to display the temperature, which will turn off as to not run down the
batteries powering the remote station.

The proposed system is going to be expandable, so the
consumer can adjust the size of the setup to suit the desired
application. For example, the user could purchase the base station and
one remote station for a one bedroom apartment with two heaters.

The proposed system will replace existing manual baseboard
heating controls. The new remote stations will use the existing control wire to connect with the
baseboard heater. The system can be installed in new construction as well as during a remodel.
Since new wiring will not need to be installed, the cost of the system will remain low, which will
also reduce the amount of waste when the system is eventually discarded.

The proposed system will be designed so that adjacent systems will be able to operate
without interfering each other. The base station will only communicate with the remote
thermostats that are in that group. This will allow an apartment building to have multiple systems
throughout.

Background and Benefits

This project has been brought about by the heating setup in my current apartment. There
are two bedrooms with a total of four baseboard heaters. Each manual thermostat needs to be
adjusted manually. Sometimes I have found that a thermostat had been left at a higher
temperature setting all night long. This is a waste of electricity and this proposed centrally
controlled system can help keep the electric bill low, by having one location to turn down all
heaters. Also by only using the heater when needed, you can increase the life of the product. It
will not break or need servicing as often. Also the temperature scale found on the wall plate does
not always correspond with the actual temperature. The proposed system’s temperature will
always be correct.

Another benefit would be during a remodel. Since the system is wireless, if the user
would like to install the proposed system, they will not have run wires from the remote
thermostats to the base station. Therefore the only wiring of the system that would need to be
inspected is the control wire to the individual heater from the remote thermostat. This saves
money by not having to buy more wire and also by not having to pay an electrician to run the
wire.
Competing Systems

There are a few thermostat systems that have a few traits in common; wireless, multiple controllers, and/or LCD; but none of these are the same as the proposed wireless baseboard heater system. The proposed system is going to be designed for a specific niche, but it is a niche which has not yet been targeted.

The Venstar Wireless Thermostat communicates with a receiver, which can be installed in place of the old thermostat. One main difference between this system and the proposed system is this system allows up to four different controllers with one receiver, while the proposed system will have one controller and control multiple heaters. Another big difference is the ability to setup a program to run the heater. This system is designed to allow the wireless controller to move to the area, which needs to be heated. The range of the wireless thermostats is 500 feet. The price is $249.99-$229.99 for the receiver and one wireless thermostat. An additional thermostat is $149.99-$129.99. The basic system includes a wireless receiver, a wireless controller, and two lithium batteries.

http://www.venstar.com/Thermostats/WirelessR/

Honeywell has the Wireless FocusPro® system, which is very similar to the Venstar system. It has a mobile controller that communicates with a fixed receiver. The proposed system will all be stationary, but multiple remote thermostats will communicate with a single base station. The user can choose between the TH6320R1004 programmable or the TH5320R1002 non-programmable model. The proposed system will not be programmable. The FocusPro® system also has a one year battery life. The proposed system will have a battery life that is comparable, if not greeter to the FocusPro® system. The price of this system is $416.63 for the non-programmable and $449.97 for the programmable model. Just like the proposed system, the Honeywell system is expandable. An additional FocusPro® thermostat is $249.97 for a non-programmable unit and $283.30 for a programmable unit. Additional thermostats for the proposed system are not currently priced. Each FocusPro® core system comes with the Wireless FocusPRO® Thermostat, THM5320R1000 Equipment Interface Module, and C7735A1000 Return Air Sensor.

http://customer.honeywell.com/honeywell/ProductInfo.aspx/YTH5320R1000

Development

The wireless thermostat will be developed using a microprocessor for the base station and each of the remote thermostats, wireless communications, and temperature circuit to sample the remote zone. The microprocessor does not need to be the fastest; I believe an 8-bit or 16-bit microprocessor would work but it will also depend on the wireless communications module that is used. The wireless system will need to conform to an existing wireless standard as to not
interfere with other wireless devices. The resources in the lab have all of the programs and hardware that will be needed to design setup and test the system.

The base station and at least two remote stations will be on display when finished. The remote temperatures on the base station will be adjustable and the LCD display will show the temperature from the two remote stations. To show the remote thermostats operating a heater, a fan, or a light bulb may be used.