PROGRESS REPORT

ECE 480

TEAM 10

March 2007

This progress report is designed to inform the reader about the current state of our project: an energy-saving thermostat utilizing the ASHRAE comfort index to promote efficient HVAC use. While the prototype is not complete as per the Gantt chart, much ground has been made on understanding the use of these previously undiscovered systems. The aforementioned details of the project are accurate as of Friday, March 16th, 2007.

Working with the power supply circuitry of the circuit, there are a few factors to address. The first factor is the 5Vdc voltage that is needed to run the digital chips within the system. Also, a switching circuit is needed to reroute 24Vac back to the furnace. The only voltage source we have is the 24Vac that is already present at the thermostat. The voltage is ran through a rectifier and then to the regulators to get a steady 5Vdc voltage. The 5Vdc voltage is going to be used for the digital chips. In addition to the 5Vdc regulated voltage, a 12Vdc voltage is created for supplying voltage to the current booster and relay triggering section of the circuit. A 741 op-amp comparator is being used to feed a current boosting circuit that is switching a relay. The current output of the comparator isn't big enough to trigger the relay, therefore, a current booster circuit is needed to assist in the switching of the relay. The control of the comparator is the output of the PSOC microprocessor. The comparator will read the PSOC output and switch the relay on/off based on the PSOC command. With the proper command from the PSOC, the relay will activate and reroute 24Vac back to the furnace and turn the furnace on.

Developing an I2C protocol is necessary for the success of our project. This presents and interesting challenge since we are using a microprocessor as a slave device. When manufacturers produce microprocessors, they usually expect them to be a master device and the instruction sets are developed around this assumption. It is then necessary to 'trick' the MPU into being a slave. A generic protocol for slave read data/address, slave write data/address, clock stretch, and slave acknowledge have been written in both

C++ and BASIC languages. This is a major step towards finishing the total I2C protocol since these routines are fully compatible and require no modification of the slave device or its code.

One of the main components of this project is the interface between the microprocessor and the SHT10 humidity and temperature sensor, provided by Sensirion. To this point, the SHT10 surface mount device has been mated to a breadboard with wires to allow for connectivity to a PIC or PSoC microprocessor. Sample code for the SHT10 to microprocessor interface has been obtained and modified to work with the PIC processor that we possess from our senior design laboratory kit. Development work is being done in Visual Basic to create a simple GUI to output the data from the SHT10 sensor to verify that the data from the device is accurate. Once the data is verified as correct, it will be interfaced with the memory to be stored for a set amount of time as per the design specifications.

As for the flash memory, the chips are currently on order and should arrive soon. Communication between the PIC and the memory requires the use of C language. The memory readily available on the PIC itself will aid in understanding how the MPU and memory communicate. This will be demonstrated by sending eight bits of information into the PIC and storing this information in the memory. Once this is complete, further programming will output this same data to LEDs to represent successful data transfer. The data input is either a one or zero and is executed using a switch which is user friendly. When the flash memory is available, this knowledge will be used to help create the memory system from the chips.

Lastly, we have a rudimentary LCD display and menu system. Progress has been made in understanding the architecture and programming of the PSoC microprocessor through this development. Coding of the display and menu routines coincides with learning the Cypress PSoC Designer software. Currently, two basic menu selection buttons are available for demonstration. A sample backlight feature for easy viewing is also present. The menu system is being enhanced as features are developed, and will be tightly integrated into the program code of the thermostat.

The design matrix was modified to reassign importance based on sponsor's feedback. Also, the criteria were analyzed for further refinement in selecting appropriate design ideas that are in line with what was most desirable for the sponsor. The ability to complete the project during a single semester was also taken into account when selecting components and features. The matrix is shown below:

Design	Installation	Flexibility	Desirability	Cost	Total	Feasible
Simple Plug	+1	5/10	1/10	5/5	12	Yes
USB Bit Bang	-1	8/10	6/10	3/5	16	Yes
I2C Wall Plate	+1	10/10	9/10	2/5	22	Yes
Temp+Humidity	+1	10/10	10/10	4/5	25	Yes
Power Indicator	+1	8/10	10/10	5/5	24	Yes
Wireless	-1	6/10	5/10	1/5	11	No
Comfort Index	-1	10/10	10/10	3/5	12	Yes
Interactive UI	-1	10/10	4/10	1/5	14	Maybe
Smart Grid	-1	4/10	9./10	1/5	13	No
Large memory	-1	2/10	8/10	3/5	12	Yes